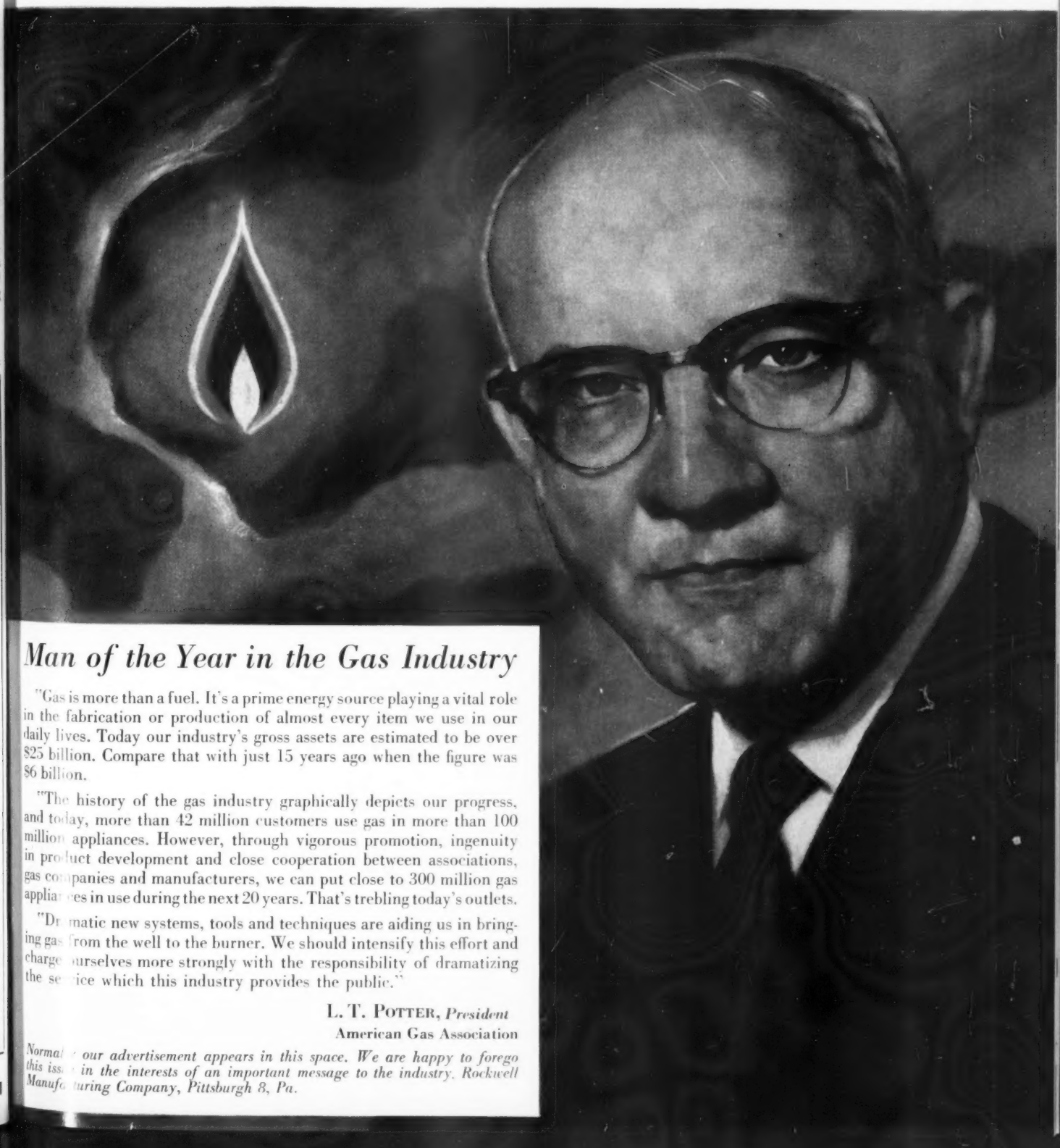
FEBRUARY 1961

The Outlook for 1961
Operation Natural Gas
New Mapping Technique

THE UNIVERSITY OF MICHIGAN

AMERICAN Gas Journal

THE MAGAZINE OF GAS DISTRIBUTION



Man of the Year in the Gas Industry

"Gas is more than a fuel. It's a prime energy source playing a vital role in the fabrication or production of almost every item we use in our daily lives. Today our industry's gross assets are estimated to be over $25 billion. Compare that with just 15 years ago when the figure was $6 billion.

"The history of the gas industry graphically depicts our progress, and today, more than 42 million customers use gas in more than 100 million appliances. However, through vigorous promotion, ingenuity in product development and close cooperation between associations, gas companies and manufacturers, we can put close to 300 million gas appliances in use during the next 20 years. That's trebling today's outlets.

"Dramatic new systems, tools and techniques are aiding us in bringing gas from the well to the burner. We should intensify this effort and charge ourselves more strongly with the responsibility of dramatizing the service which this industry provides the public."

L. T. POTTER, *President*
American Gas Association

Normally our advertisement appears in this space. We are happy to forego this issue in the interests of an important message to the industry. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

AMERICAN AL-800

For medium sized industrial or commercial loads. Weighs only 46 pounds. Rated capacity 800 cfh at ½-inch w.c. and 1700 cfh at 2-inches w.c. differential with 0.64 sp. gr. gas. 20 psi maximum working pressure. Connections 1½-inch MC. Permanent steel connection threads eliminate galling. May be equipped with Base Pressure or Base Volume Index and Volume and Pressure Gage. To be available with Temperature Compensation.

See Bulletin 317 for complete specifications.

American "design for durability" features are built into these latest additions to the Aluminumcase line, making them the most compact and lightest meters available for their capacity rating. The compact, lightweight aluminum alloy construction provides ruggedness and high resistance to impact damage with savings in shipping, handling and setting costs.

2 NEW AMERICAN® ALUMINUMCASE METERS

for small commercial and industrial loads

American's new AL-425 and AL-800 Aluminumcase Meters incorporate the same time-proven, dependable design used throughout the line of positive displacement meters. Both meters feature bellows-type Duramic diaphragms for all fuel gas services, D-slide valve construction and refinements in design and materials pioneered by American to give *longest service life at lowest cost per meter per year.*

AMERICAN AL-425

For small industrial or commercial loads. Weighs only 18 pounds. Rated capacity 425 cfh at ½-inch w.c. differential with 0.64 sp. gr. gas. 10 psi maximum working pressure. Connections 1¼-inch MC. Permanent steel connection threads eliminate galling. Available with Temperature Compensation.

See Bulletin 314 for complete specifications.

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PILOT LIGHTS

1961/Outlook

What kind of a year will it be? The gas industry's fantastic rate of annual growth has become almost routine in recent years . . . but it always deserves a second look. In 1961, the industry is expected to keep rolling ahead, break sales and revenue records, add more customers, lay more miles of mains, services, and transmission lines, sell more appliances, add more reserves, ad infinitum. Coupled with an improved economy, bolstered by optimistic, free-spending government programs, 1961 should be a good year.

Operation Natural Gas

The finishing touches to a seven-year changeover from manufactured gas to straight natural gas were applied by Boston Gas in a mammoth appliance-adjustment program that took 4½ months and put the utility's Central District on a straight diet of 1045 Btu natural gas. Scope of the project, its drama, and its results on page 26.

This & That

Ever "put one over"? Do it right and you can make math problem solving a lot easier . . . so states this month's chapter of *"Lay That Slide Rule Down,"* beginning on page 30.

Who needs cathodic protection? Maybe you do . . . declares consulting editor Herb Van Nouhuys in this month's *"Corrosion Notebook"* section, page 29.

Next Month

Tractors, trenchers, backhoes, sidebooms, air compressors, trucks, trailers, pipe tools . . . some of the essential items in gas distribution construction and maintenance. How are they used? Who uses them? Do gas distribution companies lay their own mains and services? Or do they contract them? How much of each is done by whom?

Answers to these and other questions come next month when AGJ unveils the highlights of its intensive study of *"Construction and Maintenance Equipment."* Don't miss it.

Also on tap: *The Evolution of Cathodic Protection Testing* — covering testing equipment and procedures; *Unique Sky-House Uses Gas* — novel southern California home goes first class with natural gas; plus *"Ideas At Work"* for construction and operating men and many other features.

American Gas Journal

THE MAGAZINE OF GAS DISTRIBUTION

VOLUME 188 — FEBRUARY 1961 — NUMBER 2

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Boston Gas' biggest conversion project utilized battalions of men to blanket city, put distribution system on straight natural gas diet.

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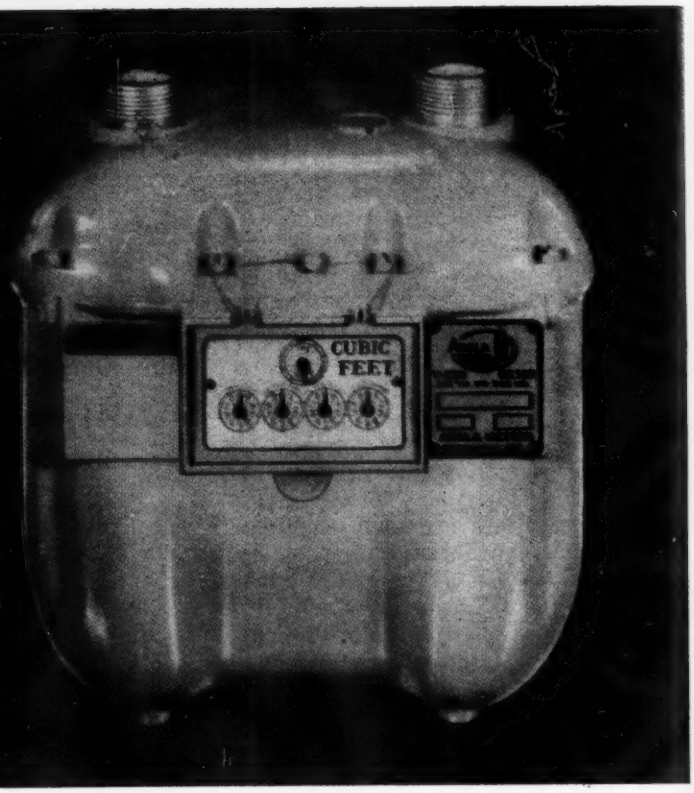
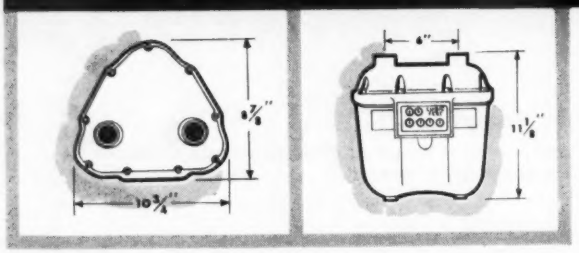
V 250 GAS METER





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NEWS HILITES OF THE INDUSTRY

A national fuels policy study in 1961? *Probably — but by whom?* Two significant Washington developments indicate a study is in the making. The Landis Report (by James K. Landis, et al, for President John F. Kennedy) was very critical of all Federal regulatory agency operations and on the subject of energy sources, urged "coordination" of both "utilization and conservation." Also in the Washington windmill is a report from Senator Paul H. Douglas, (D-Ill.) concerning depressed areas of the nation, particularly the coal mining areas. Douglas, liberal and critic of the oil and gas industry, has two top coal industry men in his study groups — L. E. Tierney, president of the West Virginia Coal Association, and Michael Widman, assistant to the president of the United Mine Workers union. The report isn't expected to be friendly to oil or gas. Adding weight to the issue is fact that the Democratic platform of 1960 "promised" a fuels policy study.

Average wellhead price of natural gas went up 1.3¢ per Mcf during 1959, compared to 1958, according to the FPC. During 1959, interstate pipeline companies paid an average of 14.3¢ per Mcf for more than 7½-trillion cu ft of gas purchased from independent producers. The 1958 average price was 13¢ and in 1957 the average price was 12¢, the FPC staff report noted. Interstate pipeline companies produced 917-billion cu ft during 1959, just over 12% of the total volume sold. Texas independent gas producers sold 46.5% of all gas purchased by the interstate pipeline (transmission) companies, and Louisiana i.p.'s sold 28.5%. Only three other states reported as much as 5% of the total sales — Kansas, 5.8%; Oklahoma, 5.6%, and New Mexico, 5%. Over 90% of all gas sold to the pipelines was produced by 270 producers, each making sales of 2-billion cu ft or more.

A firm, tough regulatory thumb under which independent producers could be kept in a strict manner has been designed by the National Association of Railroad and Utilities Commissioners in the form of "consumer protective" amendments to the Natural Gas Act. Included are four points — one that would outlaw all forms of "indefinite" pricing clauses; one that would permit FPC to suspend rate increases for industrial gas users; prohibition of new rate increase applications until FPC has passed on the "reasonableness" of all rate filing by a specific company; and last — but not least — allowing FPC to make *retroactive* findings that producer prices, *once approved* are "unreasonable."

All-time peak of $54.15 per share for natural gas common stocks was reached in December as a strong rally carried prices to their highest level at year's end, the A. G. A. reports. Prices were 13.4% higher than in December 1959. Average dividend payments rose 11%, from $2.07 to $2.30, and current dividend rates represent a yield of 4.25% to investors. Distribution company stocks noted the strongest gains . . . up nearly 22% over the 1959 year-end price.

Alaska's second gas field, the Swanson River field, on Kenai Peninsula, now under development by Standard Oil of California, may feed electric power plants instead of residential, commercial, and industrial customers. Socal is reportedly negotiating with an Anchorage utility to supply a power generating plant at the field, at a possible 16¢ per Mcf price.

Acquisition of State Fuel Supply Company by Oklahoma Natural Gas Company has been approved by SFS directors who have recommended to their stockholders the ONG proposal. State Fuel Supply serves some 12,500 customers in 16 Oklahoma communities. ONG serves nearly 400,000 over the state.

Property tax on natural gas stored underground? Mecosta County, Michigan, has imposed a property tax of that type. It's the first time such a levy has been made, according to industry sources.

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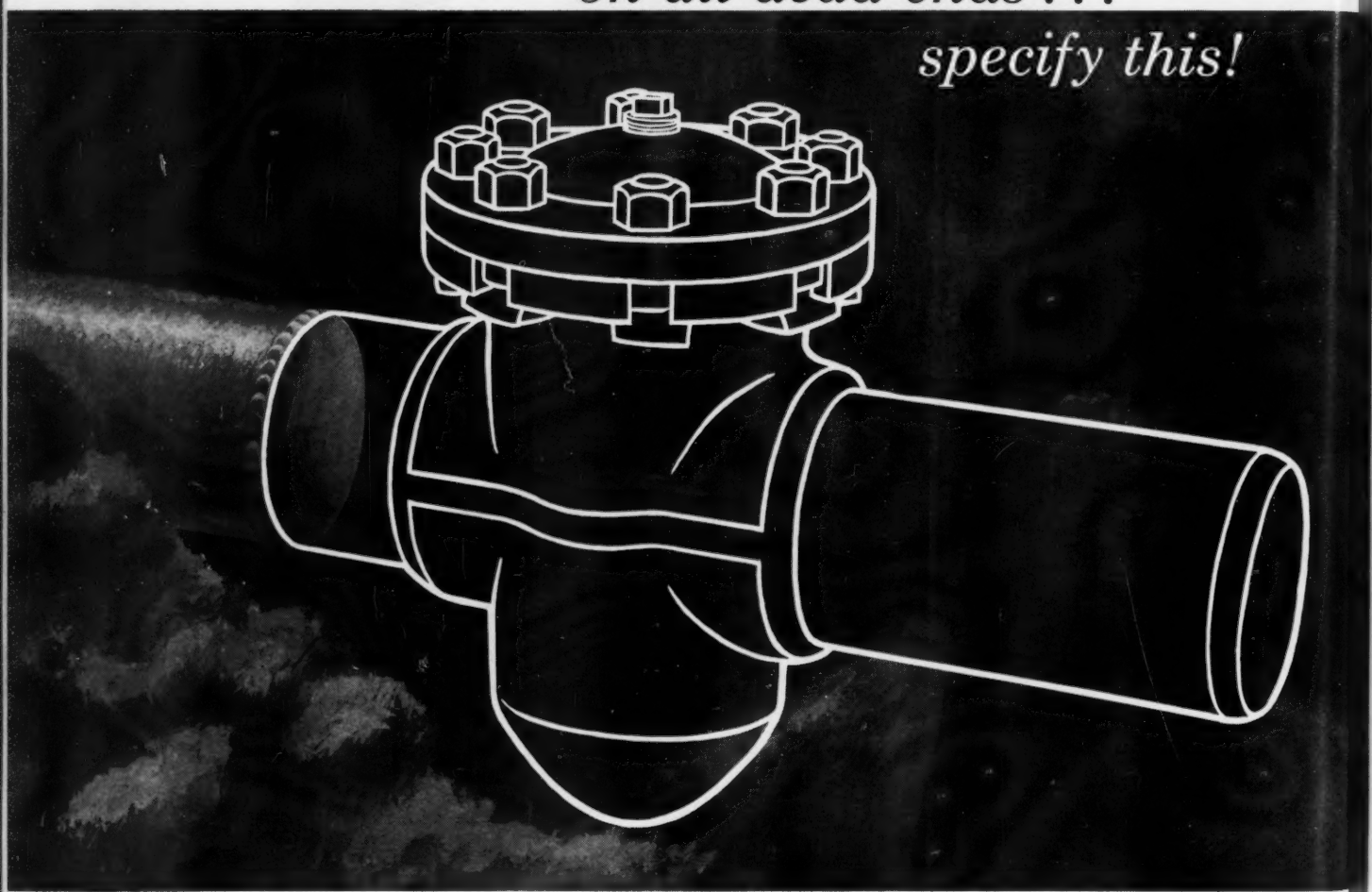
DESIGN FOR FUTURE MAIN EXTENSIONS

on all dead ends . . .



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Eliminate service interruptions when adding to your present mains. Install Mueller Extension Stopper Fittings on all dead ends at the time the main is laid. Extensions can then be added in a matter of minutes. Flow in the existing main is quickly stopped-off at the fitting while the new main is welded into place in complete safety.

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MODELS

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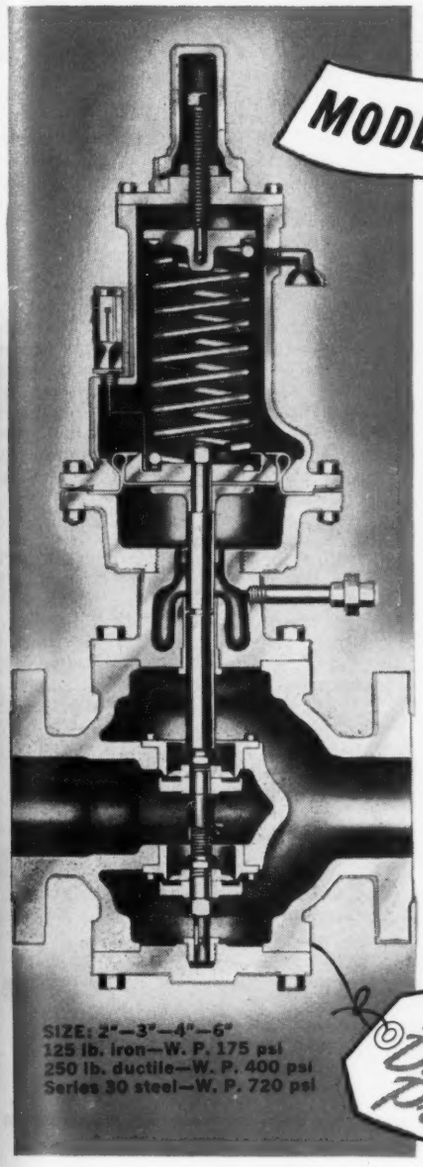
Gas Regulator



Model 57-S, for pounds-to-pounds service, operates on a new principle which maintains accurate control throughout full valve travel. The *patented* diaphragm action compensates for the "fall-off" in conventional spring regulators, which greatly limits their capacity to allowable droop. You can reduce costs greatly by installing a 57-S, one or even two sizes smaller than previously, to deliver the same volume. Usable Capacity = 100% of potential capacity. Controlled pressures—3 to 75 psi—with *one* assembly.

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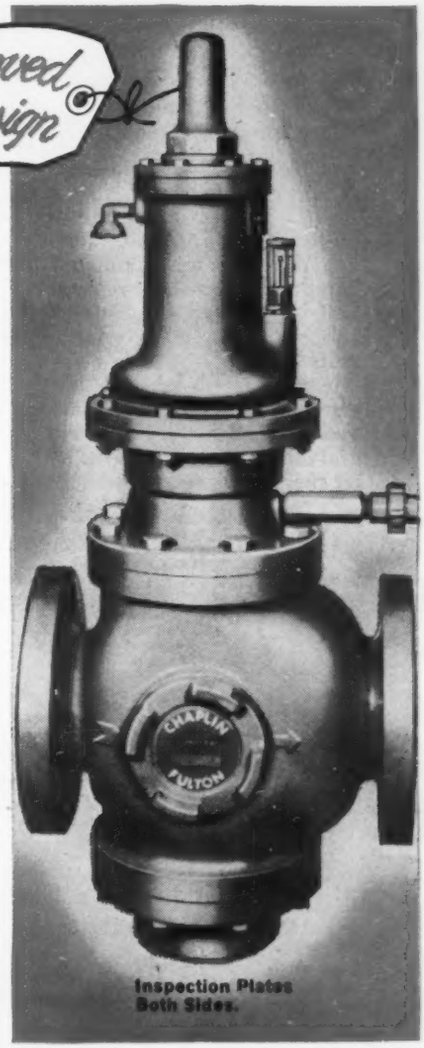

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Also, new improved body design—either 441 or 461—with enlarged flow areas and standard face-to-face dimensions for easy replacement. Available in iron, nodular ductile or electric steel. And an extra value—inspection plates on *both* sides, O-ring sealed —for quick removal and ready inspection. A valve travel indicator to check position and estimate flow, pressure and water tight.

New principle—new design—new versatility—greater economy.

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Men At Work

● **Jack A. Bell,** former executive vice president of the Gas Light Co. of Columbus, has been elected president and a director of the company. **Frank D. Foley, Sr.,** former president, has been elected chairman of the board. Other officers elected were: **Charles K. Oxford,** first vice president; **S. C. Bishop,** vice president and treasurer, and **Jack M. Averett,** vice president engineering.

● **W. J. Bowen, Sr.,** vice president and director of The Houston Corp., has been named president of the company. He is also president of Coastal Transmission Corp. and Houston Texas Gas and Oil Corp., both subsidiaries of The Houston Corp.

● **W. A. Strauss** has been named president and principal operating officer of Northern Natural Gas Co.; he will continue to be responsible to **John F. Merriam,** who remains chairman of the board and chief executive officer of Northern Natural. Strauss succeeds Merriam as president; the office of executive vice president was not filled.

● **Eskil I. Bjork,** chairman and chief executive officer of Peoples Gas Light and Coke Co., plans to retire in March; he will be succeeded by **Remick McDowell,** who is now president and director of Peoples. **Leslie A. Brandt,** comptroller and vice president, has been named to succeed McDowell as president.

● **Daniel M. Bailey** has been named executive vice president of Southern Union Gas Co. He was formerly a vice president of Continental-Emsco Co. of Dallas.

● Public Service Electric and Gas Co. of Newark, N. J., has announced the following personnel changes: **Jack V. Richards,** general staff manager of the gas department, has been promoted to general manager of the department. **Frank Freer, Jr.,** comptroller, has been elected vice president and comptroller. **Clayton S. Cronkright,** manager-area development, has been made general manager of area development.

● Philadelphia Electric Co. has named **W. G. Walkup** gas superintendent of the Schuylkill division, succeeding **R. L. Cole** who moves up to assistant general superintendent of transmission and distribution in the Philadelphia division. **Henry R. Flanegan** has been appointed manager of the Philadelphia division and customers service department. He was formerly manager of the customers service department.

● **Al Gould,** free lance public relations and advertising counsel, has been appointed news director of Northwest Natural Gas Co. to fill the vacancy created by **Merlin Blais'** resignation to join the West Coast Lumbermen's Assn.

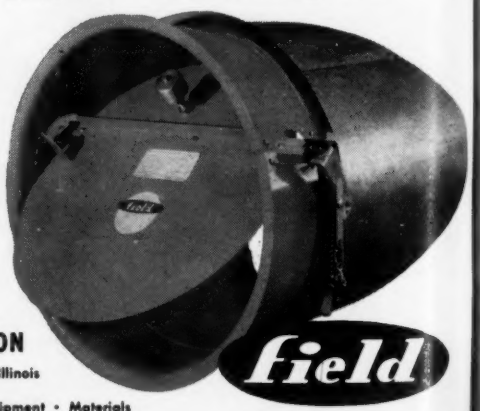
DRAFT SHORTAGES?

REPLACE THE DRAFT
DIVERTERS ON YOUR
GAS FIRED BOILERS

WITH DOUBLE-ACTING
FIELD DRAFT CONTROLS*

to overcome draft shortages, permit increased firing rates

*Field makes the draft assistance of the chimney available to the boiler for abundant draft at all firing rates, precisely controlled to the optimum twelve-to-one air-to-gas ratio recommended for clean, efficient combustion. Write for engineering data.



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Men at Work

● **Marvin E. White,** central district industrial sales manager for Ohio Fuel Gas Co., has been promoted to manager of industrial sales succeeding **Charles C. Eeles** who has been named director of business promotion for Columbia Gas System Service Corp., affiliate of Ohio Fuel.

● **John E. Overbeck,** vice president, engineering and research, of Columbia Gas System Service Corporation has retired after nearly 44-years association with companies of the Columbia Gas System.

● **Howard H. Weile,** 35-year veteran in the coast valley division of Pacific Gas and Electric Co., has been named new division manager succeeding the late T. Emmet Ward. The division includes San Benito, Monterey, San Luis Obispo, and part of Santa Barbara counties.

● **Frank Webb** of Oklahoma City has been promoted to district sales manager of the Northern Oklahoma district of Oklahoma Natural Gas Co. with headquarters in Ponca City. He was previously sales manager of air conditioning and heating for the district.

● Bryant Manufacturing Co. has appointed **Joseph "Ted" Rosenson** and **Martin J. Boyle** as regional sales managers. Rosenson will head heating and air conditioning sales efforts in southeastern district; Boyle, now in charge of Bryant's eastern district, will establish his office in Philadelphia with sales district serving New York, Pennsylvania, Connecticut, Virginia, West Virginia and District of Columbia.

● **George C. Hedrick** has been appointed manager of the Oklahoma City branch of the J. I. Case Co.; he was former manager of the Amarillo, Texas, branch.

● William B. Wickersham and Co. has been named executive sales representative in New England by Daniel Orifice Fitting Co. of Houston, Texas.

● Tube Turns Division Chemetron Corporation has established a 9-region field organization to strengthen company's nationwide marketing capabilities. Headquarters cities and newly-promoted regional managers are: Atlantic region, New York — **S. M. Hardison,** formerly Philadelphia district manager; North central region, Pittsburgh — **Herbert P. Smith,** formerly Pittsburgh district manager; northern region, Chicago — **J. C. Ellsworth,** formerly Chicago district manager; Southeastern region, Atlanta—**James F. Craig, Jr.,** manager; formerly Atlanta district manager; central region, Louisville—**E. R. Muir, Jr.,** manager, formerly Louisville district manager; midwestern region, Kansas City—**L. D. Hall,** formerly assistant manager, western sales. Mid-continent region, Tulsa—**L. O. Morris, Jr.,** formerly Tulsa district manager; southwestern region, Houston—**W. B. Whenthoff,** formerly district manager in Houston; and Pacific region, Los Angeles — **N. P. Bosemer,** formerly Los Angeles district manager.

● **G. Lewis Bridgforth** has been appointed product sales manager, unit and duct heaters, of Bryant Manufacturing Co. He was formerly with Minneapolis-Honeywell Regulator Co.

All You Want In A Small Ditcher

Vermeer Model W-3

POW-R-DITCHER

FAST! RUGGED! HYDRAULIC!

Digs 3" to 12" Widths

Equipped with 18 hp. engine, the rugged Model W-3 POW-R-DITCHER is ideal for contractors, municipalities, utilities and custom operators. Rubber-tired wheels or crawler tracks. Hydraulic drive system — no shifting. 2-way dirt conveyor. Ask for a demonstration.

PICK THE POW-R-DITCHER TO FIT YOUR NEEDS

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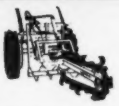
3P 

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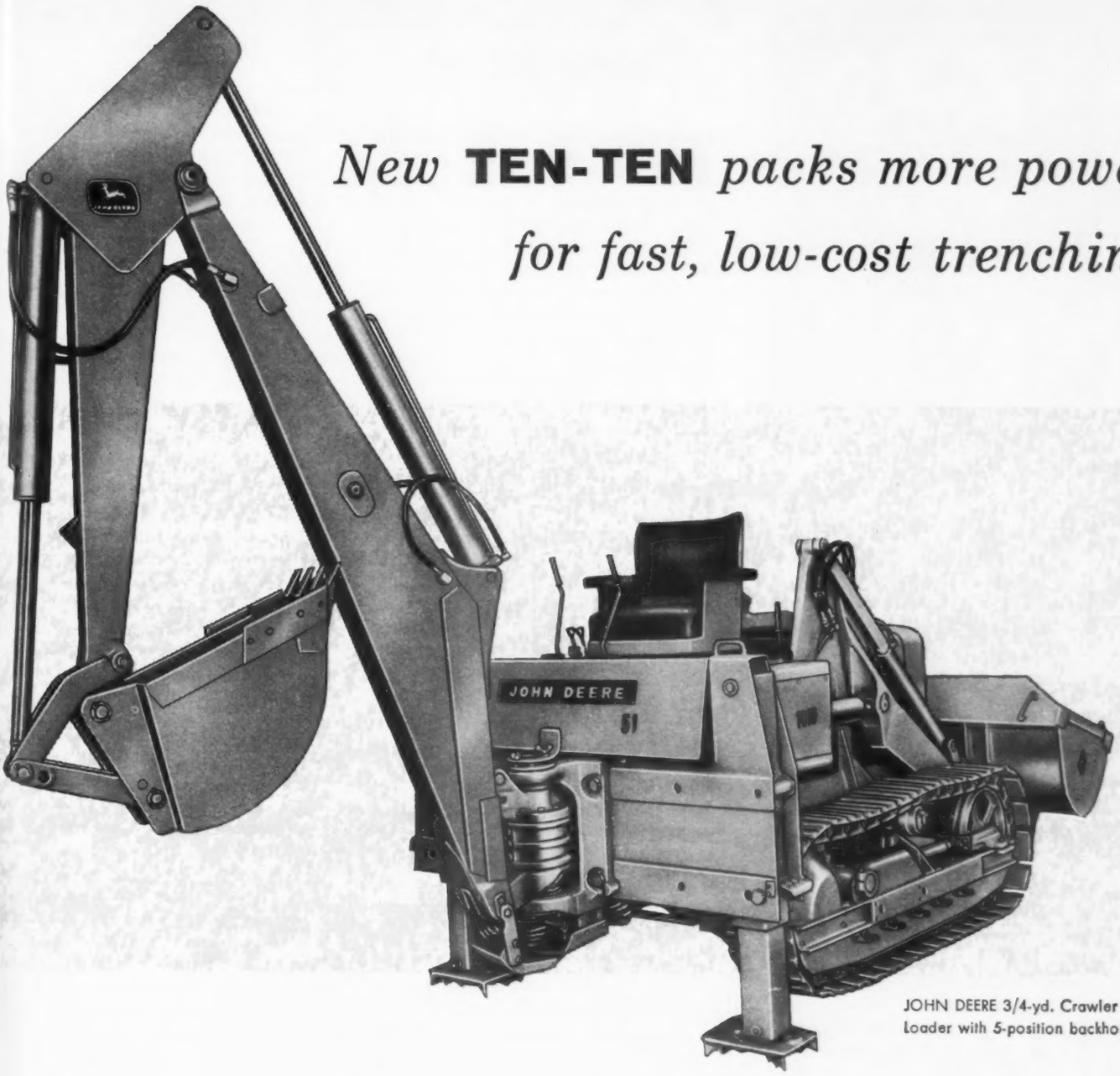

JOHN DEERE 3/4-yd. Crawler Loader with 5-position backhoe.

Now there's forty engine horsepower behind the controls of the John Deere Backhoe—smooth-handling power for efficient, on-schedule construction of gathering lines, mains, feeders and services. With either Diesel or gasoline engine, you get the benefits of John Deere's 4-cylinder, 4-cycle, valve-in-head design, with an optional new wet-clutch and hydraulic direction reverser.

Two John Deere Backhoes meet every trenching need. The five-position 51 centers or slides to flush left or right mountings for digging next to walls, fences or buildings. Both the 51 and the center-mounted 50 operate with simple two-lever control, and have individually adjusted stabilizers. Backhoe-Loaders, Backhoe-Dozers, and Crawler-Dozers with Sidebooms are standard John Deere units preferred for utility construction work.

Complete specifications are available through the John Deere construction equipment dealer. He is ready to provide information, too, on long-term leasing arrangements now available.

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BULLDOZERS
BACKHOES
AND
CONSTRUCTION
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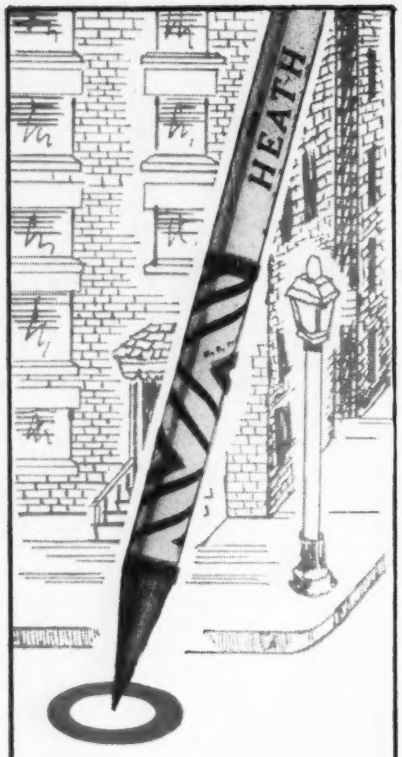

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Newsreel

Gas bill payment grows more palatable. At least one utility is making it tastier, and easier, for customers to pay their gas bills. *Southern Union Gas Company,* Dallas, late in November stopped mailing post card bills and began mailing bills in sealed envelopes . . . In addition to a new streamlined bill with customer-requested information on current meter readings as well as previous months readings, customers get a pre-addressed reply envelope complete with peppermint-flavored sealing glue. Southern Union, one of the first utilities in the Southwest to adopt the new sealed-envelope method of billing, estimates it sends out approximately 305,000 envelopes a month. In Minnesota, *Minneapolis Gas Company* has announced plans to change to the sealed envelope method of billing in early spring. Both utilities note the advantages of the new method include increased privacy for the customer, and a chance for the utility to include a series of promotional messages about the company, its products, and services.

1961 appears to be the year for new headquarters buildings. At least 5 utilities have announced plans for new construction totalling more than $34,000,000. Construction is underway on *Atlanta Gas Light Company's* 5-floor $1,000,000 office building to house operating and accounting departments of company's Atlanta activities. The building, located in southeast Atlanta across from present facilities, will have a decorative masonry grill — composed of hundreds of flame-shaped designs — extending from over the entrance to the top of the building. In Kansas City, *Gas Service Company* began construction of a one-floor ultra-modern office building at the corner of Eight Street and Armstrong Avenue late in 1960; occupancy is expected by June 1961. Building features such innovations as a drive-in teller's window to enable customers to pay bills from their cars and a roof garden atop the building — the later considered unique in the utility industry.

Biggest part of *Brooklyn Union Gas Company's* new 14-story office building program is due this year. Approximately $5,886,300 is budgeted for 1961 out of a total building cost of $11,333,800 that includes furniture, insurance and taxes. Features of the new BU building are installation on the roof of two 27-ton gas boilers that will heat and cool the offices with gas naturally, and installation in the basement of a $2,030,000 electronic brain — a 7074 series IBM data processing equipment — that will issue bills and make other accounting computations.

Early in 1961 *Michigan Consolidated's* new $20,000,000 32-story office building in Detroit at the corner of Jefferson and Woodward will get underway. It will be the first high-rise building to go up in Detroit in over 32 years. Special sidewalk superintendents club membership cards are being issued by the utility and a glass-enclosed observation room has been constructed to provide citizens with a clear view of what MichCon calls a $20,000,000 spectacular show. The new building will house Michigan Consolidated as well as its two affiliated pipeline companies, *Michigan Wisconsin* and *American Louisiana* and the parent company, *American Natural Gas Company.*

Latest announcement in headquarters building boom comes from *Northern Illinois Gas Company,* which plans to construct a tri-level building on a 112-acre site about 5 miles northeast of Aurora to house most of utility's general office functions. Preliminary estimates indicate cost will be about $2,000,000. Construction will get underway this year; completion date is set for 1963. NI-Gas has also announced plans for a new electronic billing and data processing system to be installed in the new building.

Clinched. First at the Fair. Two signatures . . . one on a contract, the other on a $100,000 check . . . have clinched another "first" for the gas industry. The industry is first exhibitor to contract for space at the 1964-65 New York World's Fair. John E. Heyke, president of The Brooklyn Union Gas Co., turned the check over to New York World's Fair Corp. early in January as president of Gas, Inc., a new gas corporation formed especially for the fair by A.G.A. Heyke observed that "history is repeating itself" as the gas industry was the first lessee to contract for exhibit space at the 1939-40 New York World's Fair.

Fastest-Growing State in Gas Customers? *Pacific Lighting Corporation* notes its two gas distribution subsidiaries, *Southern California Gas Company* and *Southern Counties Gas Company,* were serving 2,495,087 active meters at year-end. Of these, 85,847 were added in 1960.

Northern Illinois Gas Co. has signed a contract with Minneapolis-Honeywell Regulator Co. for an H-800 computer. Delivery of the data processing system early in 1963 will coincide with scheduled completion of NI-Gas' general office building at the corner of Route 59 and East-West Tollway, east of Aurora. First use of the new system will be for billing; payroll and other accounting applications, including maintenance of files of approximately 110,000 stockholders, will follow later. System is said to have sufficient capacity to aid the utility in solving many engineering, economic, and research problems.

An experimental 6-cell natural gas-powered fuel cell captured full attention of Institute of Gas Technology members and trustees at their annual meeting recently. The 2-watt unit, built primarily to test novel cell components, and to demonstrate feasibility of using natural gas, is one phase of the gas industry's broad research program to develop appliances that need no source of energy other than gas. "Development of natural gas fuel cells is now in the laboratory stage," said Dr. M. A. Elliott, director of the Institute, "but progress is encouraging, and construction of prototype fuel cell batteries will begin in 1961." A natural gas fuel cell power pack producing about 10 kw probably will be no larger than a gas furnace, Elliott noted.

Southern Gas Association has discontinued the Short Course in Gas Technology offered each spring at Texas A&I College at Kingsville, Texas, "because of changes within the industry the short course itself has helped bring about and because functions performed by the course are now being served by other SGA activities," James A. Wilson, SGA president said. SGA also conducts a Middle Management Development Short Course and a Distribution Home Study Course through Texas A&I.

Harold Massey, managing director of the Gas Appliance Manufacturers Association, has been elected chairman of the Standards Council of the American Standards Association for a one-year term beginning January 1, 1961.

New president of the National Association of Corrosion Engineers for 1961-62 is Edward C. Greco, senior research chemist of the research department, United Gas Corporation, Shreveport, La. He takes office March 17, the last day of the NACE 17th annual conference.

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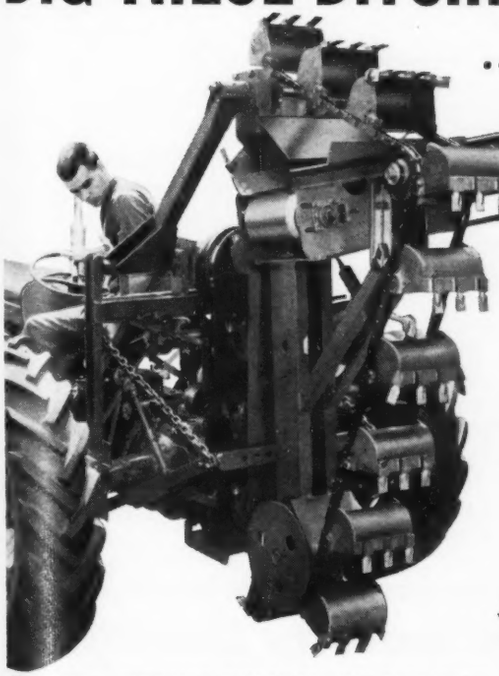

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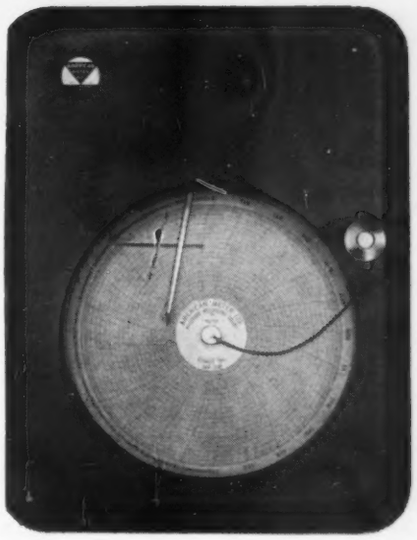

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Outlook/1961

More of everything predicted for '61 as gas industry foresees continuing growth; budgets for construction up, appliance sales upswing anticipated, distribution companies optimistic

Dean Hale, Editor

UNDAUNTED BY A SLOWED PACE IN THE NATIONAL ECONOMY'S GROWTH, the gas industry confidently expects 1961 to be its greatest year, with the cash register ringing up increased sales and revenues, accompanied by expanded budgets for new facilities to meet current and future demands for the nation's finest fuel.

While the "sizzling sixties" decade slipped and slid in getting off to a start in 1960, the gas business celebrated its 144th year with a 12 percent hike in sales and a record-making total of nearly $5.7-billion in revenues. During 1961, industry leaders predict they will pass $6-billion.

The customer total at year's end jumped to 33.5-million, sales (in therms) were up over 6 percent with 93.3-billion therms consumed, gross plant jumped to $21.9-billion, and construction expenditures for year totaled $2.175-billion.

Gas reserves climbed to their highest level ever — 262.6-trillion cu ft — and construction added nearly 9000 miles of transmission, field, and gathering lines and over 19,000 miles of new gas mains and service lines.

Gas distribution growth will continue in 1961 at a record pace. The wherewithal for this growth is seen in key figures:

- . . . $1,125,000,000 to be spent by the gas distribution industry for expansion, replacement, maintenance, and new equipment. Total gas industry expenditures will reach $2.375-billion.
- . . . 12,600 miles of new mains to be installed.
- . . . 7600 miles of new service lines to be installed.
- . . . 950,000 new customers to be added.
- . . . gross plant expected to reach $23.6-billion in 1961.
- . . . underground storage development to greatly increase, nearly $100,000,000 budgeted already.
- . . . increased promotion and advertising by A.G.A. (PAR) and gas utilities in all areas with new, intensive programs in industrial and commercial gas utilization areas.

Gas Supply Outlook. More gas for more areas . . . particularly Canadian gas for the upper Midwest and California . . . highlights the 1961 outlook in natural gas supply. During 1960, a 565-mile network built by Midwestern Gas Transmission Corporation began delivery of gas from western Canada to areas in Minnesota, Wisconsin, and Illinois. Construction is also underway on a 614-mile line from the Idaho-British Columbia border to the Oregon-California border, where delivery will be made to Pacific Gas & Electric Company for northern California customers.

California gas supplies were also boosted with completion of the 1800-mile Transwestern Pipeline Company system delivering gas from West Texas and New Mexico to southern California customers.

Canadian gas is expected to begin flowing to the U.S. in 1961 through lines of Montana Power Company and El Paso Natural Gas Company. Another project, by Tennessee Gas Transmission, would import gas at Niagara Falls.

Conditional approval has been given by FPC for the "Rock Springs" project of El Paso Natural and Colorado Interstate Gas Company, involving 650 miles of line from Wyoming to the California-Nevada border for delivery of 470,000,000 cu ft daily to southern California.

Alaska will become the 47th state to have natural gas during 1961, with completion of a distribution system in Anchorage, supplied by an 80-mile line from gas wells on the Kenai Peninsula.

Gas Appliances In Use

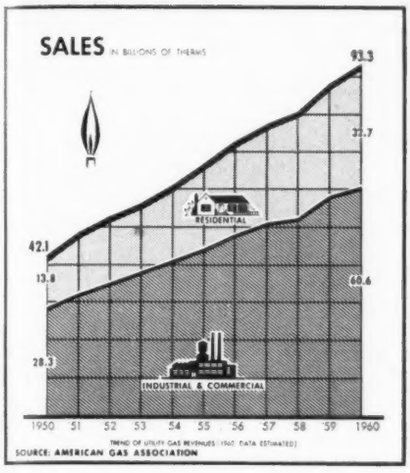
	Total (Dec. 31, 1960)
Gas Ranges	34,025,000
Gas Water Heaters	24,725,000
Gas Refrigerators	3,200,000
Gas Clothes Dryers	3,250,000
Gas Incinerators	550,000
Gas Lights	300,000
Gas Central Air Conditioning	32,000
Gas Central Heating Systems	12,925,000
Gas Space Heaters	24,050,000
Gas Wall and Floor Furnaces	6,800,000
TOTAL	109,857,000

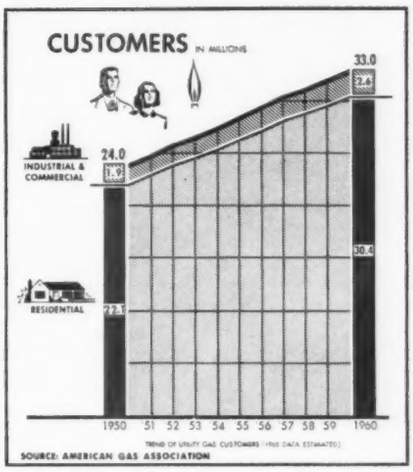
Gas Storage. Approximately $100,000,000 will be spent in the next three years to increase underground storage capacity for natural gas. Approximately 220 storage fields, with capacity of 2.5-trillion cu ft, are now in operation. During 1960, more than $76,000,000 was spent to extend these "banks" to provide winter peak service gas.

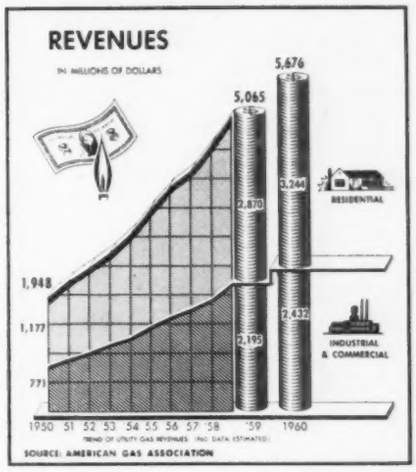
Use of LPG by gas distribution companies declined during 1960 due to mild weather and the widespread extension of natural gas lines to areas formerly served only with LPG. Consumption by distribution companies during the year was estimated at 140,000,000 gallons.

For the record: Significant 1960 Gas Industry Statistics

33,458,300	Customers on December 31	**$5.675-Billion**	Total Revenues for Year
12,100	Miles of New Mains Installed	**8.02-Million**	Unit Sales of Appliances for Year
7,200	Miles of New Services Installed	**$21.9-Billion**	Value of Gross Plant on December 31
901,000	New Customers Added	**262.6-Trillion**	Cu Ft Proved Recoverable Reserves
93.3-Billion	Total Sales in Therms for Year	**$2.375-Billion**	Construction Expenditures for Year







Installation of large LPG storage facilities for peak shaving purposes is expected to increase during 1961, and with the general growth of natural gas systems, more LPG will be used for peak shaving. Distribution companies are expected to develop more underground LPG storage, especially mined storage caverns. An increase in the use of refrigerated storage is also foreseen.

Construction Outlook. As residential housing grows, so grows the gas industry. With a new administration in Washington, money for financing housing will be "easier" and more housing starts are forecast.

With few exceptions, nearly every type of construction will show a gain during 1961. Private construction will be at its dollar peak, with more apartment houses, motels, and hotels slated to keep up with the rise in population and its increasing mobility.

Gas appliance sales held up well in 1960, despite a severe drop in new housing starts. The decline in appliance demand for new homes was offset largely by big gains in gas appliance installations in home renovation projects. Gains in the home modernization market put the gas appliance manufacturing industry in good position for 1961, when home building is expected to brighten.

Substantial sales gains are expected in 1961 for all major gas appliance and equipment categories. Sales are expected to exceed 8,500,000 units, compared to 8,000,000 in 1960.

Industry Research. Research conducted under the PAR program in 1960 included nearly 85 projects in gas air conditioning, gas operations, distribution, pipeline research, domestic-industrial-commercial utilization, and special research projects. Among the research developments:

. . . a small but powerful natural gas fueled gas turbine for use as a prime mover in the residential and commercial markets.

. . . a 50-ton gas engine-driven air conditioning system for commercial and industrial applications.

. . . smaller gas-engine driven air-conditioning systems for homes.

. . . a gas-engine driven heat-pump for residential use.

. . . study of methods for pinpointing leaks in gas distribution systems by sonic methods, evaluation of internal leak sealants, evaluation of plastic materials, and a new concept for liquefied gas storage.

. . . development of fuel cells and thermoelectric energy devices.

★ ★ ★

U. S. Construction Picture for 1961

(Millions of Dollars)

	1960*	1961**	Percent Change
Residential			
Private	21,950	22,600	+ 3.0
Public	725	775	+ 7.0
Total	22,675	23,375	+ 3.1
Industrial			
Private	2,900	3,100	+ 7.0
Public	400	400	—
Total	3,300	3,500	+ 6.0
Commercial	4,050	4,150	+ 2.0
Religious	1,045	1,075	+ 3.0
Educational			
Private	590	650	+10.0
Public	2,875	3,100	+ 8.0
Hospitals			
Private	575	625	+ 9.0
Public	400	425	+ 6.0
Public Utilities			
Electric Light & Power	2,050	2,050	—
Gas	1,700	2,000	+18.0
Sewer & Water Systems	1,500	1,525	+ 2.0
Other Construction	14,340	14,825	+ 3.4
Total New Construction	$55,100	$57,300	+ 4.0

*Bureau of Census Statistics.
**Estimates prepared by Business and Defense Services Administration and U. S. Department of Commerce.

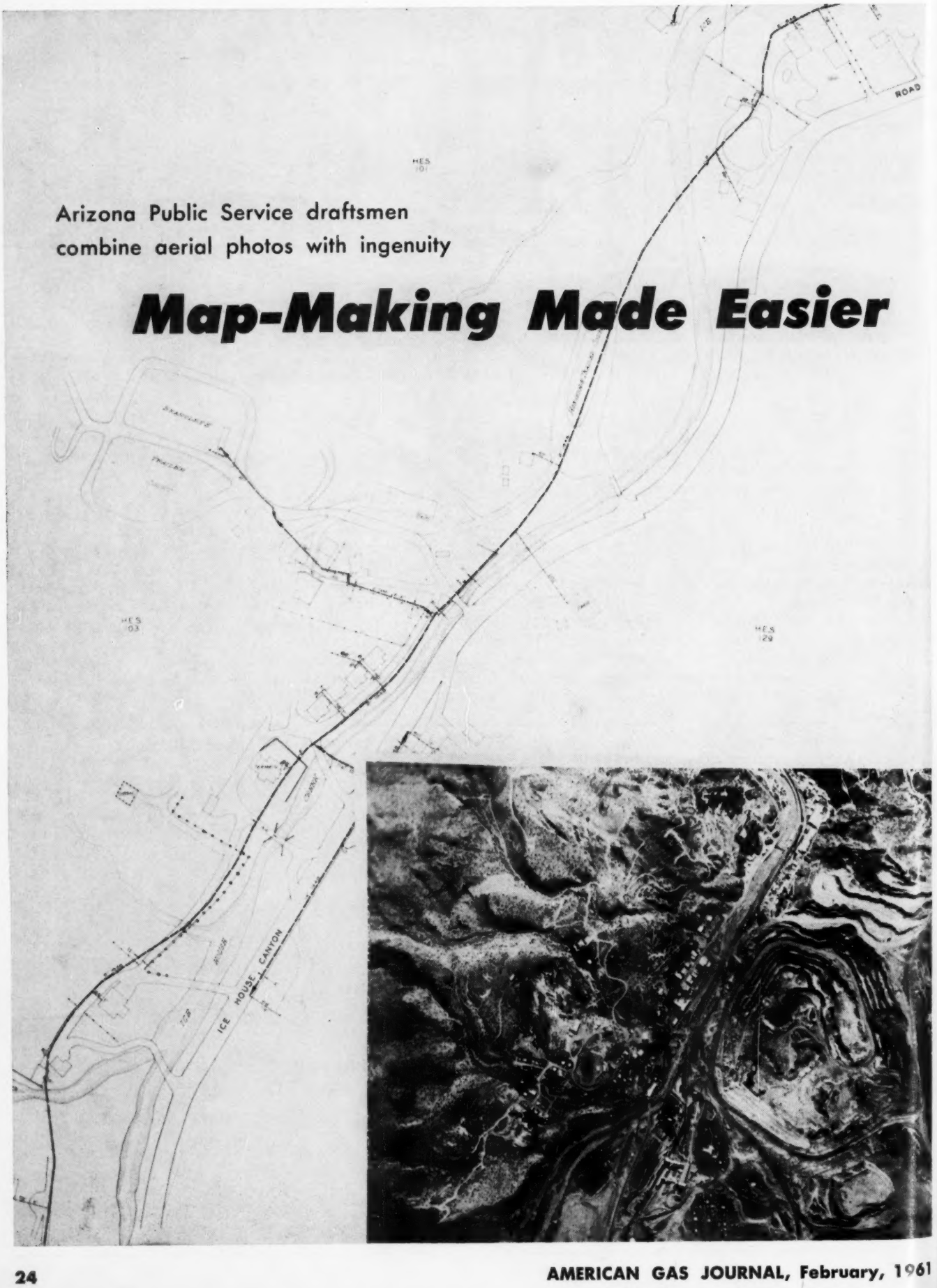
Outlook For Gas Appliance Sales

	1960*	1961 (Est.)	Percent Change
Domestic Gas Ranges	**1,844,100**	**1,876,500**	**+ 1.8**
Free Standing	1,489,300	1,483,600	— 0.4
Built-In	354,800	392,900	+10.7
Automatic Water Heaters	**2,662,400**	**2,702,300**	**+ 1.5**
Central Heating	**1,175,000**	**1,247,800**	**+ 6.2**
Warm Air Furnaces	897,100	964,000	+ 7.5
Boilers	143,200	149,600	+ 4.5
Conversion Burners	134,700	134,200	— 0.4
Househeating	**1,647,800**	**1,667,200**	**+ 1.1**
Direct Heating	1,192,200	1,219,600	+ 2.3
Recessed Wall Heaters	369,600	365,800	— 1.0
Floor Furnaces	86,000	81,800	— 4.9
Clothes Dryers	**433,000****	**472,000**	**+ 9.1**
Combination Washer-Gas Dryer	**51,000*****	**63,800**	**+25.0**
Incinerators	**42,500**	**46,400**	**+ 9.2**
Gas Unit Heaters	**140,400**	**143,300**	**+ 2.1**
Duct Furnaces	**26,200**	**28,900**	**+10.3**
TOTAL	**8,022,400**	**8,248,200**	**+ 2.8**

*GAMA 10 month actual, 2 months estimated (Gas Appliance Manufacturers Association).
**American Home Laundry Manufacturers Association, estimated.
***AGJ estimate of gas units in total combination washer-dryer sales.

Arizona Public Service draftsmen
combine aerial photos with ingenuity

Map-Making Made Easier



Donn Nobles, *Supervisor, Maps and Records, Arizona Public Service Company, Phoenix, Arizona*

Six-Shooter Draw and Icehouse Canyon may sound like neighborhoods for outdoor fun and excitement. Maybe so, if you're just visiting them, but not if you're in the business of serving natural gas. It's up and down country, cross-cut with gullies and sprinkled with rocks, spattered thick with mesquite and other desert plants. It's just plain hard to travel in, harder still to see far enough to find your way around.

So, for Arizona Public Service Company, the regular ways of doing things are often as ineffective, inefficient, and uneconomical as were the ways in the days of the buggy, the horse and the old wooden well bucket.

The company's system maps and records section had always found it difficult to make accurate, complete maps of gas distribution systems in these rough-terrained territories. It required the expenses and time of a three-to-five man survey crew out in the field for several days, plus a large amount of similar footwork for the draftsmen themselves, checking and re-checking information. Even then, maps weren't always as accurate as they should have been.

Draftsman Ed Schaefer didn't like the walking through the rocks and brush any more than the rest of the crew. More than that, he was determined to save some of the wear and tear on his feet.

He devised this easier way:

First, take a highway map, either state or county, and draw the principal road or highway in the area onto blank mapping paper, placing it in its proper relation to the section corners.

Get an aerial photograph of your desired area, a directly vertical shot, covering a square mile. Make an 8 by 10 glossy print.

Hang your diagram of the four section corners and highway on the wall.

Put the photo in an opaque projector. Match the road in the photo exactly with the road on the diagram, by moving your projector a bit this way or that.

Sketch in with pencil all houses, secondary roads, main buildings, trails, reservoirs, prominent landmarks, rock walls, swimming pools, football fields and what-have-you.

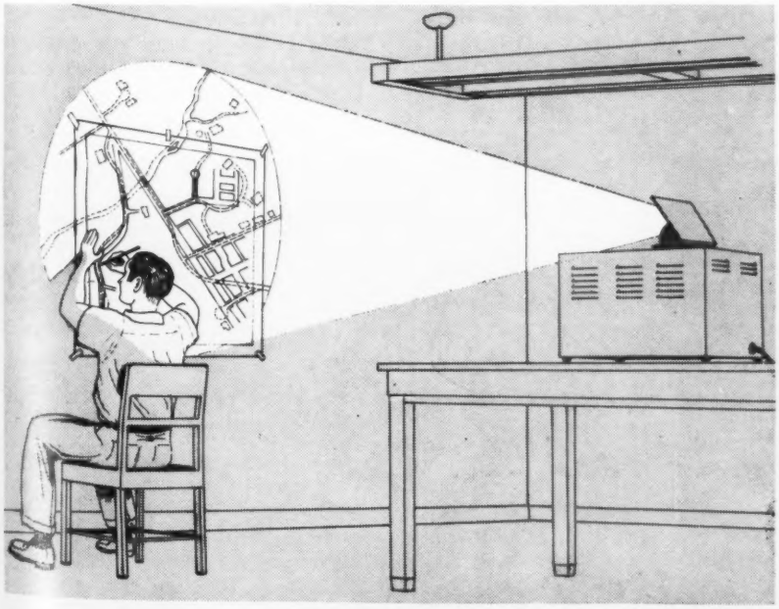
You can now take your pencil-drawn map into the field and trace every service from meter (customer) to main with an electronic pipe finder.

Any fill-in sketching for completion may be also made quickly in the field.

You have saved countless hours in the field with the aerial photo-opaque projector system. All your information is tied down exactly in proper relation to section corners.

Two men can now do all the work in less than half the time.

That's the way Ed Schaefer saved himself and the rest of the crew a lot of wear and tear on the feet. * * *



Map making procedure is simple — project aerial photo onto area sketch, matching principal roadway, then draw in remainder of items shown by photo.

Detailed map — and aerial photo from which it was made — are shown in actual size.

Aerial photo/opaque projector system is a time and money saver. Author Donn Nobles, left, readies area sketch as Ed Schaefer puts photo into projector.

Boston Gas' biggest project utilized battalions of men to blanket city, put distribution system on a straight natural gas diet in mammoth 4½-month undertaking

Operation Natural Gas

David L. Turley,
Staff Assistant,
Boston Gas Company, Boston, Massachusetts

Three buses converted to mobile repair units for use in the field were located at strategic points throughout the work areas.

Boston Gas Company has noted many historic dates during its 138 years of service to Boston, but none have been more significant than August 6, 1960.

On that date the company turned natural gas into its Central District distribution system, putting the company's entire system on straight natural gas.

It also marked the "wrap up" of a 4½-month appliance adjustment project costing $2,500,000 and involving more than 650,000 manhours. Some 680,000 appliances were adjusted, including 34,000 house heating jobs; 33,000 refrigerator jobs; and approximately 97,000 commercial and industrial applications of all types.

The change to straight natural gas of 1045 Btu content, from a 900 Btu mixed gas, also served to increase the capacity of Boston Gas' system by 16%. Over a seven-year period, since the introduction of natural gas in 1953 in the company's West District, and later the South District, therm capacity of the distribution system has increased 100% (including the last and final conversion).

Coke Oven To Natural Gas

The Central District is made up of Boston and eight surrounding towns, with 280,000 customers using over 680,000 appliances.

While other districts converted to straight natural gas in 1953, the Central

Nerve center of field headquarters was this battery of phones where customer requests and appointments for service were processed. Approximately 500 calls a day were received through this office.

Progress reports kept management up to date on daily progress. Here John Bacon, staff engineer, customers' service and field coordinator for the adjustment program, checks data with M. F. Knowy, assistant vice president, utilization and research.

Hundreds of thousands of letters were sent to customers throughout the program. Special letter in Chinese to customers in China Town district of Boston is examined by John Donoghue, left, staff assistant, customers' service, and Fred Beals, special assistant, distribution.

Approximately 700,000 work orders on customers' appliances were kept in long row of filing cabinets. IBM machine at left processed orders at night so that accurate records were available each morning on the work completed and the work yet to be done. At left is James Muir, order table adjuster, application and investigation department, who supervised customer telephone requests throughout the conversion program.

District had been operating on a mixed gas made up of coke oven gas, water gas, and natural gas.

Over the years, the heat content of the mixed gas has been gradually increased to meet growing demands for more and more gas service. This was done by adding more natural gas to the mixed gas.

Prior to arrival of natural gas in New England in 1953, Boston Gas was delivering 528 Btu coke oven gas to its Central District customers. In October 1953 the heat value was raised to 581 Btu; in August 1955, raised to 610 Btu; in June 1957, raised to 640 Btu; in August 1958, following a similar appliance adjustment, raised to 800 Btu, and in August 1959, heat value was boosted to 900 Btu. The 1960 changeover to straight natural gas raised the heat value to 1045 Btu.

"Operation Natural Gas"

The final change to straight natural gas required adjustment of all customer appliances in the Central District. Thus "Operation Natural Gas" came into being.

570 men from Adams Natural Gas Conversions, specialists in this field, and a nucleus of 30 Boston Gas Company employees did the job.

The big project got underway in March. It demanded the precision and teamwork of a military operation. Hundreds of thousands of letters had to be mailed to customers. Hundreds of thousands of parts had to be stocked. Special buses were outfitted as repair shops and special telephone lines had to be arranged. A variety of 40 cards and tags had to be printed. No detail could be overlooked.

Training & Operations

A central field headquarters was set up in an empty building near the company's McBride Street operations center in Jamaica Plain. After a week of special training, the Adams' crews moved into the district to work on customer appliances. Backing them up at headquarters was a remarkable system for processing both work completed and jobs yet to be done.

A battery of phones handled customer requests. Work orders, IBM cards, inspection reports, and a continuing process of checking, cross-checking, eliminating, and filing gave the men and the company a daily picture of how the program was moving.

The crews worked 10 hours a day, six days a week. They also worked closely with the company's sales department to provide information on sales potentials or outmoded equipment that needed replacement. These leads resulted in many sales and improvements in customer installations.

Thousands of spuds, flashtubes, pipes, caps and a hundred different necessary parts needed for the job were coded and binned in a cellar stock room of field headquarters.

Area by Area Conversion

By the end of April, the East Boston, Chelsea, Quincy, and Milton areas of the district had been adjusted and

natural gas had been turned into those areas.

The crews then moved to the remaining sections and to the compiex network of Boston and the other central area communities . . . the last and toughest leg of the journey. By July, they were in Boston proper.

At headquarters, long ro .ɔ filing cabinets rapidly filled up with completed work orders. The company's Arlington Street accounting department had been advised to base its billing calculations on an August 6 deadline for "turn in" of natural gas to the reminder of the district. On every calendar at field headquarters, August 6 was marked as "the red letter day."

As the final three weeks rolled around, it became clear that the program was running ahead of schedule and would be completed before the deadline. A threat of loss in precious work time came from Hurricane Brenda on July 30, but even Brenda cooperated and turned away from Boston to the open sea.

As August appeared on the calendar, orders were few. The men were working on special jobs. The end was in sight. Customers in the last few areas had been alerted by letter weeks ahead . . . so that those who would be away at the scheduled adjustment time could make appointments to have the work done in advance.

Final Check

Still remaining was the tiresome but all-important job of checking each appliance listed in the thick ledger books to make sure no one had been overlooked.

Each listing had to have a date stamp and the initials of the man who completed the job before the green light could be given for the turn in of natural gas. The turn in came at 5:00 a.m. on August 6, as scheduled.

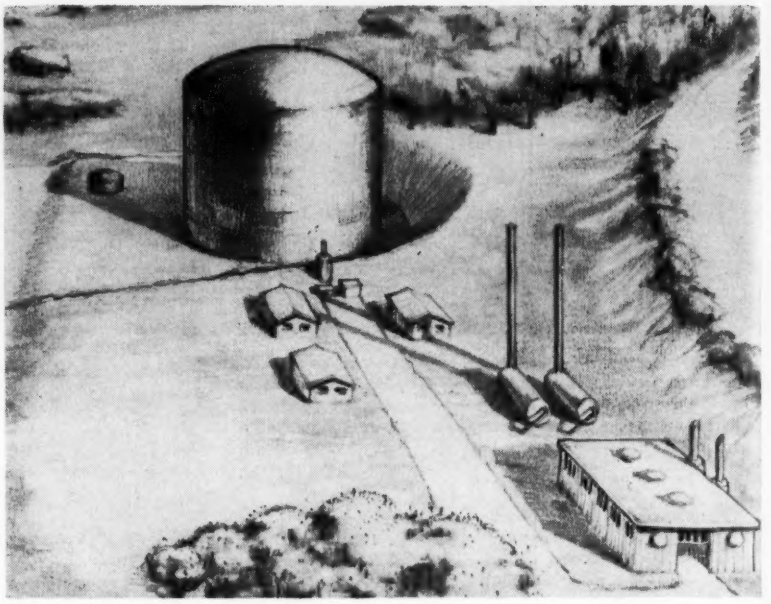
The Adams Company management called it the smoothest, best organized adjustment program they had ever worked on.

The final adjustment, together with previous step adjustments and Btu increases, constituted one of the most economical transitions from manufactured to natural gas ever made by a major gas utility in a metropolitan area.

Some cleanup work and paper work remained after August 6, but Boston Gas was finally operating completely on straight natural gas for the first time in its history.

For the company, this important project aided operations by putting the entire system on a single type of gas. It also provided needed additional therm capacity to meet increasing demands for gas service. * * *

Minnegasco Plans Biggest Refrigerated Storage Tank



Artist's sketch of world's largest tank for propane storage — 120,000 bbl capacity at —50 F. The double wall tank — 106 ft in diameter and more than 100 ft high — will be the heart of Minneapolis Gas Company's new refrigerated facility for liquefied gas storage.

A 120,000 bbl propane storage tank — the world's largest — will be the heart of a giant new refrigerated facility for liquefied gas designed to nearly double the present propane capacity of Minneapolis Gas Company. Scheduled to begin operation in June, 1961, the complete facility will be designed, built, and placed in service by Chicago Bridge & Iron Company.

Paul W. Kaemer, operations vice president for Minneapolis Gas, said the new method would cut unit storage costs on liquid propane about 75%. Kraemer noted that the program would cost substantially less than contracting for additional natural gas supplies to meet consumer demand on the relatively few winter days it is needed.

Main storage will be in a double wall tank designed by CB&I to contain 120,000 bbl of propane at −50 F (equivalent to 137,500 bbl at +60 F). The outer tank will be 106 ft in diameter and more than 100 ft high. This outer steel shell — combined with 30-in. of insulating material — will form a vapor-tight barrier to the inner vessel, which will be fabricated of a special code-approved steel.

CB&I will provide refrigeration equipment in two sections: 1) "Holding" equipment with sufficient refrigeration capacity to maintain the tank temperature and pressure within the design limits on the hottest day, and 2) "Filling" equipment capable of holding the tank while receiving 90 F propane at a rate of 120,000 gal per day. Both electric motors and internal combustion engines will be employed as prime movers. Other equipment includes a generator, driven by an internal combustion engine, with sufficient capacity for "hold" refrigeration and supply of emergency power.

Normal process control, tank temperature, and pressure will be under constant control of a complete instrument system that also is designed to meet any emergency. For example, a tankful of propane at −50 F would not reach 1.0 psig for 8 or 9 days, even in the summer, without external refrigeration.

The refrigeration system features a separate and independent refrigeration cycle for condensation in the self-refrigeration cycle. Vapor from the storage tank never attains ambient or elevated temperatures, thus reducing purge gas volume and simplifying the control system.

Fully refrigerated storage was selected for the new plant, Kraemer stated, after a thorough study. Lower cost, ease of storage expansion, accurate gaging, consistency, and purity of propane and ease of storage inspection were cited as major reasons for selection of refrigerated storage. * *

Do You Need Cathodic Protection?

Herbert C. Van Nouhuys, Consulting Editor

A professor of electrical engineering told this anecdote on himself before his class many years ago. Returning home one afternoon, he noticed a white card stuck under the doorbell. Not having recalled seeing this before, he bent over and read in very small feminine print:

"Bell out of order — A. H. Lovell, Electrical Engineer"

Needless to say, his wife won her point and the long idle doorbell was finally repaired.

The point illustrated is that we sometimes put off unpleasant tasks that we know must be done, and if we don't take the initiative — someone else will — to our chagrin. The professor knew better than to ask, "Do I need an electrician?" Managers of smaller gas companies and municipal systems today know better than to ask, "Do I need cathodic protection?"

The difference, of course, is that while the professor should have been able to do his own repair job unaided, the gas manager will often need to call on some reliable outside engineering help to get started on the right foot.

Nevertheless, for many gas companies, cathodic protection is in the same status as the doorbell was for the professor.

In the case of newer municipal systems, the reason is quite clear — the design engineers neglected to include money in the original bond issue estimate for either a corrosion survey, or for cathodic protection. At about the time the young system needs cathodic protection, other system improvements and expansions are often given financial precedence, and the corrosion pits get deeper.

One municipal gas manager stated that one corrosion leak on his system cost $12,000. This is more than a cathodic protection system would have cost.

Part of the reasoning applied by the system's original designers was that corrosion is a slow process, and would be still slower with a well coated system for both mains and services, and cathodic protection could be applied later — "if needed."

This is dangerous reasoning. Corrosion leaks have occurred on new 8-in. pipe within two years after installation. On new 8-in. coated pipe, leaks can occur in less time than this, because current leaving an anodic area on a bare pipe will usually leave from a larger area than it would from a coated pipe (where current would leave from pinholes).

If the available discharge area through a holiday (defect in coating) is the size of a dime, one milliampere flow could cause a cone-shaped penetration in one year on 8-in. pipe with a .322-in. wall thickness.

Such a case is rare, of course, but at a time when the gas industry is more safety conscious than ever before in history, gas costs are at an all time high, and the cost involved for adequate cathodic protection is only in the order of 1 to 2% of the system investment, unnecessary risks of this magnitude call for more attention by top management.

Corrosion engineers still occasionally hear requests for a survey "to determine whether or not cathodic protection is needed." This is usually in connection with a coated system. If the coating were perfect, and the soil homogeneous and level, and these conditions would remain static, cathodic protection would not be needed.

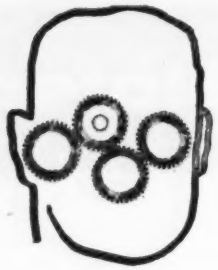
Cathodic protection and coatings were made to go hand in hand — unfortunately, the wedding often takes place after the coating has been found to have its limitations and the pipe has reached critical conditions. In this situation it is unsafe to allow the cathodic protection plant to lie idle even for a week, lest a new leak occur in the interim.

The better the quality of the coating, the lower will be the cost of cathodic protection. The acid test of an installed coated system is the corrosion engineers' current requirements test.

By dividing the current needed to obtain the desired protective potentials by the total square ft of pipe surface under protection, we obtain *average current density per square foot*. The following table classifies coatings with respect to the average current density, in *microamperes per square foot*, required to produce cathodic protection in high resistivity soils:

Grade of Coating	Average Microamps per Square Foot
Excellent	0.0 to 5.0
Good	5.1 to 10.0
Average	10.1 to 20.0
Poor	21 to 100
Very Poor	101 to 200
Bare	201 to 1000

* * *

Using the Gears  Between the Ears

LAY THAT SLIDE RULE DOWN!

Part 2

FUN WITH RECIPROCALS

Prof. Paul J. Grogan, *Chairman*
Department of Engineering, University Extension Division
University of Wisconsin, Madison, Wisconsin

Often a problem solution will result in the reciprocal of a certain number. In mathematics as a science it is common to leave the expression in that form, which is of course the exact answer.

In engineering work, however, the decimal fraction form of answer is generally to be preferred despite the loss of an exact solution when the conventional three or four significant figures of the answer are shown.

The decimal equivalents of all integer fractions falls into two rather obvious classes. They are either exact decimal fractions, which may be expressed in a finite number of places, or they are never-ending decimals. It may not be so obvious, however, that the never-ending decimals invariably settle down to the endless repetition of a certain sequence of one or more integers.

Some examples of exact decimal fractions are

$$1/16 = 0.0625.$$
$$1/125 = 0.008.$$
$$1/4{,}096 = 0.000244140625.$$

The exact decimal fractions are relatively uncommon, stemming from just those denominators which contain no prime factors other than two and five. *There are but 40 such exact decimal equivalents of the reciprocals for all integers up to and including 4096, the last example cited above.*

Some never-ending decimals that repeat the same integer after one or more places are:

$$1/3 = 0.3333333333\ldots$$
$$1/45 = 0.0222222222\ldots$$
$$1/576 = 0.0017361111\ldots$$

These decimal fractions appear only if the integer three is one of the prime factors of the denominator. The mere presence of three as one of the prime factors, however, does not assure a constantly repeating single integer as in the examples mentioned here.

Another form of never-ending decimal fraction repeats a certain small group of integers.

$$1/11 = 0.09\ 09\ 09\ 09\ \ldots\ldots$$
$$3/22 = 0.136\ 36\ 36\ 36\ \ldots\ldots$$
$$1/55 = 0.018\ 18\ 18\ 18\ \ldots\ldots$$

Nevertheless, the decimal fractions that repeat a somewhat lengthy sequence of integers over and over again are more interesting. We have reference to decimal fractions of the form:

$$1/7 = 0.142857\ 142857\ 142857\ \ldots\ldots\ldots\ldots$$
$$1/13 = 0.076923\ 076923\ 076923\ \ldots\ldots\ldots\ldots$$

These decimal fractions are particularly unusual. They appear as the reciprocal of a prime number. The preceding statement may be challenged as not applying to the instances of 2, 3, 5, and 11, and not be true for the prime numbers 1, 2, 3, and 5, but it has been found to be true for every other instance investigated by the writer.

Another property exhibited by these repeating decimals is that the fraction begins to repeat itself in the nth place in the example of $1/n$, providing n is a prime number other than the four exceptions noted above. The decimal fraction of 1/13 repeats itself in the thirteenth place, the "double frequency" notwithstanding. Similarly, the decimal fractions representing 1/17 and 1/19 repeat themselves in the seventeenth and nineteenth places, respectively.

The interval of the cycle always involves an even number of decimal places. This would appear to be a condition imposed by meeting the requirement of beginning to repeat in the nth place, where n must necessarily be odd if it is to be a prime number other than two.

Having established that these cyclic groups always contain an even number of digits, we may divide them into two equally long integer groups and demonstrate another property that we shall call "being complementary with respect to nine about the mid-point." For the decimal fraction representing 1/7, we recall the sequence 142857.

The sum of the two parts, 142 and 857, is 999. The six-figure group that repeats in the instance of 1/13 may be written in two parts, 076 and 923. Again, they add to 999.

The same may be said for the reciprocals of 17 and 19 which appear below with the second half of the sequence arranged under the first half:

$$1/17 = 0.05882352\ 94117647\ 05882352\ 94117647\ \ldots\ldots$$
$$\underline{94117647}$$
$$99999999$$

$$1/19 = 0.052631578\ 947368421\ 052631578\ 947368421\ \ldots$$
$$\underline{947368421}$$
$$999999999$$

This feature, when put to work, makes it possible to find the last $\frac{(n-1)}{2}$ places of the decimal sequence for the prime number, *n*, simply by inspection.

From the foregoing it is hoped that a little interest has been aroused that will cause the reader to familiarize himself with the first dozen reciprocals. From a few, a great many others can be found.

For instance, the reciprocal of 15 is merely one-third of the reciprocal of five. We may readily establish,

$$1/15 = (1/3)\ (1/5) = \frac{0.2000}{3} = 0.0666\ldots.$$

Similarly,

$$1/14 = (1/2)\ (1/7) = \frac{0.142857\ 142857\ldots..}{2}$$
$$= 0.07\ 142857\ 142857\ldots...$$

And,

$$1/18 = (1/2)\ (1/9) = \frac{0.11111\ldots.}{2}$$
$$= 0.055555\ldots..$$

Note the persistence of the sequence, 142857, in reciprocals involving seven as a prime factor of the number.

Once the form of the cycle has been established, it may often be applied in expressing decimal fractions where the numerator is an integer other than one. The following sequences are illustrative:

$1/14 = 0.07\ 142857\ 142857\ldots$	$1/18 = 0.055555\ldots$
$2/14 = 0.142857\ 142857\ldots$	$2/18 = 0.111111\ldots$
$3/14 = 0.02\ 142857\ 142857\ldots$	$3/18 = 0.166666\ldots$
$4/14 = 0.2857\ 142857\ldots$	$4/18 = 0.222222\ldots$
$5/14 = 0.3\ 57\ 142857\ldots$	$5/18 = 0.277777\ldots$
$6/14 = 0.42857\ 142857\ldots$	$6/18 = 0.333333\ldots$

Thus, once the repetitive sequence is recognized, the result may be written down to any desired number of places.

A working knowledge of the decimal equivalent of integer fractions may be used to good advantage in a great many applications. In Part I, it was pointed out that the difference between the squares of two consecutive integers is simply the sum of the two integers.

Turning the same statement around, we have a method at hand that is useful in finding square roots rather than squares.

We might reason that $\sqrt{13}$ lies somewhere between three and four; being very nearly $\frac{4}{3+4}$, or 4/7, of the interval from three to four. Our experience with decimal fractions would indicate the answer to be close to 3.6.

Ordinarily, an engineer would not be interested in extending the approximation into the third significant figure since our data and method involve only one and two place numbers. The actual root, to five significant figures, is 3.6056.

Another example is $\sqrt{158}$. This number lies between 12 and 13. We expect it lies near $\frac{14}{12+13}$, or 14/25, of the interval toward 13. Expressing three significant figures, the answer is quickly estimated to be 12.6. Attempting to stretch out a fourth yields 12.56. The actual root is 12.5698.

We sense now that our method results in answers that are slightly in error, a fact that can be verified by comparing the actual function $y = x^2$ between any pair of consecutive integers with the straight-line approximation method we are substituting in its place. The comparison will also reveal that the accuracy improves when bigger numbers are involved.

A simplifying, and often corrective, step which can be taken in working with larger numbers such as $\sqrt{927}$ is to assume that (30 + 30) in the fractional denominator is very little different from (30 + 31). Hence, $\sqrt{927} = 30\ 27/60$, or 30.45. Actually, to four decimal places, the answer is 30.4467.

Similarly, if we desire the solution of $\sqrt{888}$, we may conclude the number lies near to 30, but is nearly 12/60 of the interval toward 29. Our solution suggests 29.80 as the root. The more exact solution obtained by extraction of the root is 29.7993. A typical slide rule answer for the above problem will be no better than the results obtained by the suggested method.

As a general rule, the approximation is both easier and more accurate in working from the perfect square nearest to the number given under the radical. As an example, $\sqrt{248}$ may be estimated as being 15 + 23/30, or 16 − 8/32. The solutions are respectively, 15.77 and 15.75. The actual root is 15.748.

Having observed that the accuracy of the approximation method improves in working with larger numbers, we would like to return to the original example, $\sqrt{13}$. Should we be able to extract the square root of 1300, additional significant figures will be obtained.

Recalling methods from Part I,

$$35^2 = (3)\ (4)100 + 25 = 1225$$

And,

$$36^2 = 35^2 + 35 + 36$$
$$= 1225 + 71 = 1296$$

Thus,

$$\sqrt{1300} = 36 + 4/72 = 36 + 1/18$$
$$= 36.0555\ldots = 36.056$$

Removing the factor of ten, our solution now checks precisely with the four-place calculation cited heretofore.

Returning now to finding reciprocals, mention is made of two other types that can be handled with relative ease after a little practice. They are of the form,

$$\frac{1}{1-x} \text{ and } \frac{1}{1+x}$$

where x is a small number when compared with one. We may establish identities helpful in these instances by carrying out the indicated division for each of the algebraic fractions.

$$\frac{1}{1-x} = 1 + x + x^2 + x^3 + x^4 + \ldots. + x^n + \ldots$$

$$\frac{1}{1+x} = 1 - x + x^2 - x^3 + x^4 - \ldots. + (-x)^n - \ldots$$

Thus,

$$\frac{1}{0.99} = \frac{1}{1.00 - 0.01} = 1 + 0.01 + 0.0001 + \ldots$$
$$\cong 1.0101$$

And,

$$\frac{1}{1.02} = \frac{1}{1.00 + 0.02} = 1 - 0.02 + 0.0004 - \ldots$$
$$\cong 0.9804$$

Application may be made with problems involving 9.9 and 102, or any other similar values, where proper regard is given to the location of the decimal point.

To show the limit of these methods where four significant figures are desired, several values are tabulated below. The identities involve geometric series where each additional term increases the number of decimal places by two. We have shown three terms of each series so that we may properly appraise the effect of the third term upon the last significant decimal place.

x = 0.05	x = 0.07	x = 0.09
1/0.95	1/0.93	1/0.91
1.000000	1.000000	1.000000
0.05	0.07	0.09
0.0025	0.0049	0.0081
0.000125	0.000243	0.000729
1.053	1.075	1.099

It is not until x = 0.09 that the third place of the decimal is affected by the third term of the series. Actually, because of common familiarity with the squares and cubes of 11 and 12, the method may be used to determine,

1/0.89	1/0.88
1.11	1.12
0.0121	0.0144
0.001331	0.001728
1.123	1.136

A further interesting method for determining reciprocals may be explained by assuming the problem of 1/41. We first reason that the desired reciprocal is close to 1/40. We readily recognize the latter as being 0.0250. Just how far removed from 1/40 are we?

Performing the subtraction to see what difference there actually is,

$$\frac{1}{40} - \frac{1}{41} = \frac{41-40}{41 \times 40} = \frac{1}{1{,}640} \cong 0.0006$$

Therefore,

$$\frac{1}{41} = \frac{1}{40} - \frac{1}{1{,}640} = 0.0250 - 0.0006$$

$$\cong 0.0244$$

Calculating the reciprocal to a few more places reveals 1/41 = 0.024390.

Similarly, we may estimate the reciprocal of 79,

$$\frac{1}{79} = \frac{1}{80} + \frac{1}{6{,}320} = 0.01250 + 0.00016$$

$$\frac{1}{79} \cong 0.01266.$$

It matters little whether the product of 79 × 80 is evaluated or whether 6,400 is used in determining the difference between these two reciprocals. In the more recent instance the magnitude of the second term is but little more than 1% of the first term. A 10% to 20% error in the determination of this increment scarcely affects the significance of the answer as ordinarily reported. ●

Gas "Blanket" Reduces Storage Tank Losses

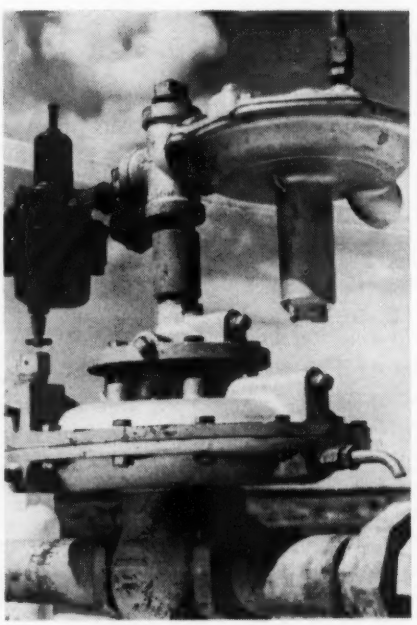
A simple gas regulator and pilot — used in place of an instrument air controller for controlling a "gas blanket" — has reduced venting losses to a minimum during the past two years on 21 fluid storage tanks at a large oil refinery in the Southwest.

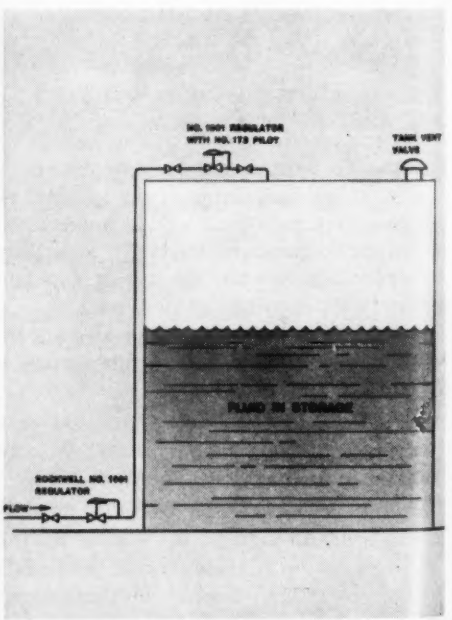
Very low pressure natural gas is fed into the top of each storage tank to blanket the fluid in the tank. Reasons for blanketing the fluid in storage are three-fold:

- **it eliminates corrosion** by preventing the gathering of moisture in the storage tank;
- **it prevents product contamination** by acting as a shield against the atmosphere;
- **it maintains positive pressure** on the tank during pump-out periods.

Each pilot regulator is designed by the manufacturer to control a low outlet pressure, normally about 0.4-in. water column. As a double check, each regulator is tested in the refinery instrument shop. To pass the test, the main valve must drop wide open when outlet pressure decreases to 0.3-in. w.c. and close when outlet pressure increases to 0.5-in. w.c.

This regulator and pilot control system, is less expensive than comparable instrument air controllers, and consumes less natural gas than other systems, thus resulting in operational savings. Each tank is equipped with suitable safety relief devices to prevent over-pressuring the tank. Close control through use of regulators minimizes the amount of natural gas consumed in the blanketing operation, as safety relief devices vent less gas to the atmosphere than with other systems used in the past that required almost constant venting. ★ ★ ★





Gas regulator with pilot, left, is mounted on top of fluid storage tank. It controls natural gas, which "blankets" fluid in the tank.

Diagram, at the right, shows typical piping installation supplying natural gas at 0.4-in. w.c. to blanket fluid in storage tank.

Nation's newest innovation in warm air heating systems is being tested by Nicholas George, Jolly Roger Roger Drive-In Theater owner, left, and Russ Allen, Durant & McAlpine heating engineer.

Drive-In Theater Goes First Class, Warm Air for Patrons, Heated by Gas

The nation's first warm air heating system for outdoor theater goers has been installed at the Jolly Roger Drive-In in Detroit. Nicholas George, owner of the Jolly Roger, said he expects to keep his patrons warm throughout the winter.

In working with the owner, Michigan Consolidated Gas Company was confronted with a new problem: *Spot heating in the great outdoors.*

After intense research, Fred A. Kaiser, vice president and general sales manager of the utility, said: "This heating system required many extras in planning, drafting and engineering to build a 1200 car heating system. We are now satisfied that central heating for drive-in theaters in northern states is practical."

Secret of George's car warming system at the Jolly Roger lies in a vault-like area where his customers will never see it.

A specially built concrete-block furnace room has been built alongside the concession stand to house two large gas fired furnaces that can produce enough heat to warm 70 average size homes.

To solve the problem, Michigan Consolidated Gas Company ran a gas service line 750-ft from Van Born road to the two furnaces. Russ Allen, of Durant & McAlpine heating contractors, designed and directed installation of the heating system.

Warm air will be pumped from the furnace room through two underground primary ducts, then through 36-in. lateral ducts for each row of cars. Through the use of flexible tubing and nozzles, warm air will be run from the lateral lines to specially built posts at each car position. Nozzles from the posts to the cars will supply the heat.

The new car heating system changes the drive-in theater business completely, says George. By operating 12 months of the year, he expects to double his business.

"First customers will come just to see how it's done," predicted George. "They will discover we can heat their cars while they watch the movie in comfort, the same as in their homes. Now we can keep going all winter, even when the temperature reaches zero . . . and operate at about one third the cost of electric heaters with double the heat of my other drive-in theater," he said. "The circulating warm air system will also eliminate inside frost on car windows and only one unit will be needed for each car."

George also plans to use warm air ducts for gas air conditioning to cool his customers during hot summer months next year. ★ ★ ★

How Do You Rate As a Supervisor?

Robley D. Stevens,
Management Consultant, Washington, D. C.

MAINTENANCE OF SOUND SUPERVISOR-EMPLOYEE RELATIONSHIPS contributes to the success of the total management program of gas distribution companies.

As a supervisor, you are a member of management who has been delegated certain authority to manage a department or operating group. You are the one to whom others look for orders, discipline, proper instructions, and supervision. Most employees feel that what you, as their supervisor, say and do, represents management. If they like the way you do things and handle people, they will produce more and, as a result, morale will be higher. Good supervisory leadership on your part goes a long way in helping solve many management-employee problems.

In order to accomplish your employer's objective you have to perform a multitude of duties and responsibilities. Here are some important things you should keep in mind about this association.

√ **A systematic merit-rating program** will provide management with information essential to gain the highest supervisory quality and performance. No merit-rating program is a substitute for intelligent and enlightened personal relations, but, it can be applied in a practical manner to help supervisors improve their efficiency.

√ **Skills and abilities** of all employees need to be fully utilized; burden of accomplishing this fall squarely upon management. If supervisors are inefficient, full utilization of employees is licked from the start. Increase in personnel turnover rates may be minimized by providing high quality supervision.

√ Good supervisory selection and training is important to every employer, but if it is not supported by adequate supervisory rating, it may be substantially nullified. Giving a rating of "supervisor" to those who lack the personal qualities and abilities required for supervisors is like watering a garden where nothing has been planted.

√ All employers in the gas industry—large and small — are concerned with **cost.** Improperly selected, trained, and rated supervisors are costly. This factor is increasingly recognized by busi-

SUPERVISOR SELF-ANALYSIS CHART

The following check list will give you some idea of how you are doing as a supervisor in your company and also will help point out areas where you might improve. Check yourself with a yes or no now.

1. Understanding the Organization

DO YOU . . .	Yes	No
Understand the functions of your department and how they contribute to the total program of your company?	☐	☐
Show each worker how his job fits into the overall picture?	☐	☐
Know how to determine your supervisory lines of authority and responsibility?	☐	☐
Determine the number and type of employees required in your department?	☐	☐
Make a logical assignment of employees based on a clear outline of your supervisory authority and responsibility?	☐	☐

2. Getting the Work Out

DO YOU . . .		
Give instructions that are clear, understandable, and specific?	☐	☐
Review the work of your own department?	☐	☐
Coordinate work in your department?	☐	☐
See that employees do what is required of them?	☐	☐
Emphasize control of cost?	☐	☐
Minimize the necessity of overtime work?	☐	☐
Resolve your supervisory problems at once?	☐	☐

3. Planning and Scheduling

DO YOU . . .		
Keep up with the department workload?	☐	☐
Give priorities of work and schedule proper attention?	☐	☐
Plan for better use of manpower, equipment, and space?	☐	☐
Set realistic goals for employees?	☐	☐
Encourage employees to do more?	☐	☐
Plan to meet deadlines and emergencies?	☐	☐

4. Working Methods

DO YOU . . .		
Analyze department operations?	☐	☐
Evaluate present methods of performing work?	☐	☐
Develop and apply improve methods?	☐	☐
Place workers where they are most effective?	☐	☐

nessmen today. It's a rare thing to find any organization that reviews its supervisory jobs in the light of rewarding dogged, faithful service. A systematic, purposeful approach to filling supervisory jobs is growing as the rule in management.

Value of Merit-Rating

Value of a supervisory merit-rating program is twofold. It not only gives management a clear picture of those individuals who are above or below par, but it also affords a factual and non-emotional basis for discussing each supervisor's good or weak points with a view toward up-grading his work and supervisory performance.

Such supervisory merit-rating program pays dividends. It will turn up supervisory talent that might otherwise go unrecognized. For example, in a smaller firm, persons with good supervisory potentials are frequently overlooked; in a larger firm the risk is substantially magnified.

Such a program is a sort of insurance policy against appointment of individuals who just can't make the grade as supervisors.

Knowledge that a definite merit-rating program is in effect often relieves the employee anxiety that he is not getting recognition he merits. It also salves the wounds of disappointed employees to know that their abilities were considered, and that they may try again for the next supervisory opening.

The Search For Supervisors

Studies by management today indicate that employers in the gas industry look for the following qualifications in supervisors:

Leadership and organizing ability;
technical skill;
initiative;
judgment;
physical and mental alertness.

Today, many firms endeavor to find people within their own organizations who can be promoted to the job of a supervisor whenever a vacancy occurs. This policy has a definite bearing on the growth and development of supervisors. Today, more and more skilled workers in American business are looking for jobs that offer "career" opportunities. If management holds to a policy of "promotion from within," employees feel the company offers "career" possibilities.

First step in any merit-rating program entails that of **job analysis**—what the supervisor does and the requirements for his job. Analysis, therefore, provides management with specific information as to the nature of a particular supervisory job.

Often, however, in the analogous situation of selecting a supervisor, there is some temptation to try to fill the job without realizing that anything more than a supervisor is wanted. All supervisory jobs have some common elements, but no two supervisory jobs are alike, the differences, in many instances being as important as the similarities.

Today, employers in the gas industry are in need of supervisory leadership of the highest quality. It is an art that may be acquired, cultivated, and practiced by all who supervise. But it is a continuing process. Careful delineation of the background and characteristics required for supervisory jobs can eliminate many undesirable people for the job.

Analyze Yourself

Here is a self-revealing, self-analysis for every supervisor. It can enable you to determine your adequacies or inadequacies. Listed are duties and responsibilities of a supervisor. The manner in which you perform each of these duties and responsibilities determines your success or failure. The checklist will also help you identify the duties on which you need to concentrate the most.

Finally, the tests are meant merely as a guidepost to help you become a better supervisor. You can evaluate yourself by answering all the questions. A "Yes" answer to them all, means you are managing your resources to get results, working together with others, for more management power. Check yourself carefully. Find your rating below. What is your score? * *

5. Performance Requirements

DO YOU . . .		
Decide what is expected of each person?	☐	☐
Determine work requirements based on company needs?	☐	☐
Evaluate objectively each person's performance?	☐	☐
Schedule work in department in proper sequence?	☐	☐

6. Development of Employees

DO YOU . . .		
Select right person for right job?	☐	☐
Help personnel adjust on new jobs?	☐	☐
Determine training needs of each employee?	☐	☐
Recommend on-the-job training?	☐	☐
Determine effect of employee-training in terms of cost and improved skills?	☐	☐
Let each employee know how they are doing on job?	☐	☐
Discuss career opportunities?	☐	☐
Develop a good understudy?	☐	☐

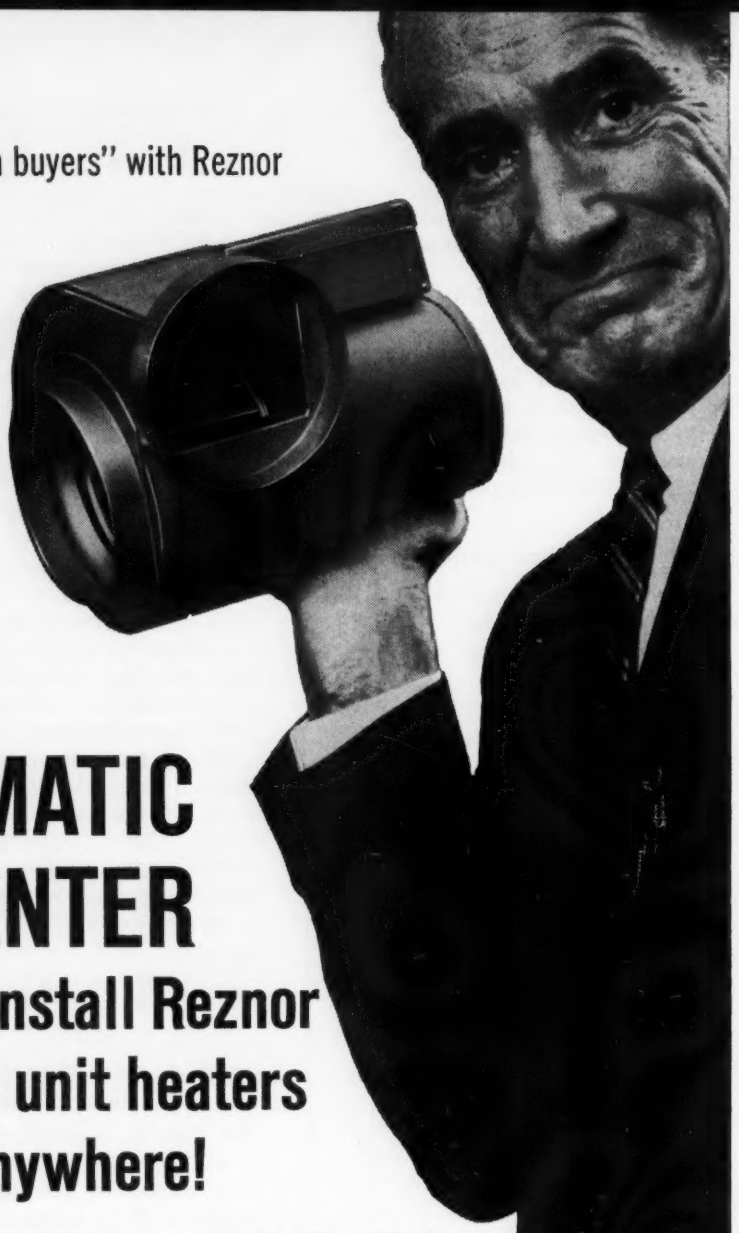
7. Cooperative Work Force

DO YOU . . .		
See that personnel are rewarded for jobs well done?	☐	☐
Commend entire group on performance when deserved?	☐	☐
Transfer and reassign employees for best use of their abilities and experience?	☐	☐
Have confidence and loyalty of your workers?	☐	☐
Adjust employee grievances objectively?	☐	☐
Keep workers informed of company policies?	☐	☐
Stress safe working habits?	☐	☐
Maintain effective discipline?	☐	☐
Hold down operating costs?	☐	☐
Maintain quality standards?	☐	☐

8. Self Improvement

DO YOU . . .		
Recognize your own short comings?	☐	☐
Improve your own technical knowledge and skill?	☐	☐
Strive to get along with people?	☐	☐
Develop a cooperative attitude toward your own job?	☐	☐
Seek or avoid responsibility?	☐	☐
Keep abreast of new developments?	☐	☐
Like to supervise?	☐	☐
Need additional training?	☐	☐

Sell more "tough buyers" with Reznor



NEW AUTOMATIC VENTER

lets you install Reznor gas-fired unit heaters almost anywhere!

Now, with the Reznor Venter, you can install gas-fired Reznor heaters where you couldn't before—in multi-story buildings or structures with hard-to-get-at chimneys! You'll save money for your "tough buyers," and sell more unit heaters, too.

The Venter, available exclusively with Reznor Heaters, is a motorized automatic vent exhauster that mounts directly on the heater. You simply install a 4-inch diameter vent pipe to carry burned gases to a sidewall—or down through the floor and out, if you choose. No more costly roof venting or big, expensive flues. Heaters operate more efficiently, too, especially if the room has an exhaust fan which creates a negative pressure.

There's a Venter for all Reznor Heaters up to 300,000 Btuh. Ask your representative for Catalog SA-5900, with data on all Reznor Heaters and the new Venter. Or write Dept. 66-W, Reznor Manufacturing Co., Mercer, Pa.

USE THE REZNOR VENTER AND AVOID THESE PROBLEMS:

Big, expensive flues | Costly roof venting | Inaccessible venting | Negative pressures

REZNOR HEATERS

"WORLD'S LARGEST SELLING DIRECT-FIRED HEATERS"

Calendar

OF COMING EVENTS

February

2 NEGA gas utility managers conference, Parker House, Boston, Massachusetts.

8 A.G.A. textile and paper processing committee, Charleston, South Carolina.

9-11 A.G.A. home service workshop, Sheraton-Cleveland Hotel, Cleveland, Ohio.

13-16 American Society of Heating, Refrigerating and Air Conditioning Engineers, semi-annual meeting, Chicago, Illinois.

15 NEGA street department supervisors group, Hotel Bancroft, Worcester, Massachusetts.

23-24 A.G.A.-PCGA-C.G.A. joint public relations conference, Benson Hotel, Portland, Oregon.

24 NGAA South Louisiana regional meeting, Petroleum Club, Lafayette, Louisiana.

March

13-17 National Association of Corrosion Engineers, annual conference, Hotel Statler, Buffalo, New York.

15-17 NGAA 40th annual convention, Baker and Adolphus Hotel, Dallas, Texas.

16-17 SGA distribution management, Dinkler Plaza Hotel, Atlanta, Georgia.

16-17 NEGA annual meeting, Statler Hilton Hotel, Boston, Massachusetts.

20-22 A.G.A. general management section annual conference, Francis Marion Hotel, Charleston, South Carolina.

27-28 Mid-West Gas Association annual meeting and convention, Sheraton-Fontenelle Hotel, Omaha, Nebraska.

April

4- 6 A.G.A. research and utilization conference, Sheraton Cleveland Hotel, Cleveland, Ohio.

6 Pennsylvania Gas Association, fourth annual 1-day distribution conference, Tally Ho Inn and Hotel, Valley Forge, Pennsylvania.

6- 7 PCGA distribution conference, Biltmore Hotel, Los Angeles, California.

7 Maryland-District of Columbia Utilities Association spring conference, Lord Biltmore Hotel, Baltimore, Maryland.

9-13 ASME Oil & Gas Power conference and exhibit, Jung Hotel, New Orleans, Louisiana.

10-21 American Welding Society, International Institute of Welding, annual convention and welding exposition, Sheraton-Atlantic, New York, New York.

11-13 A.G.A. sales conference on industrial and commercial gas, Prince Edward Hotel, Windsor, Ontario, Canada.

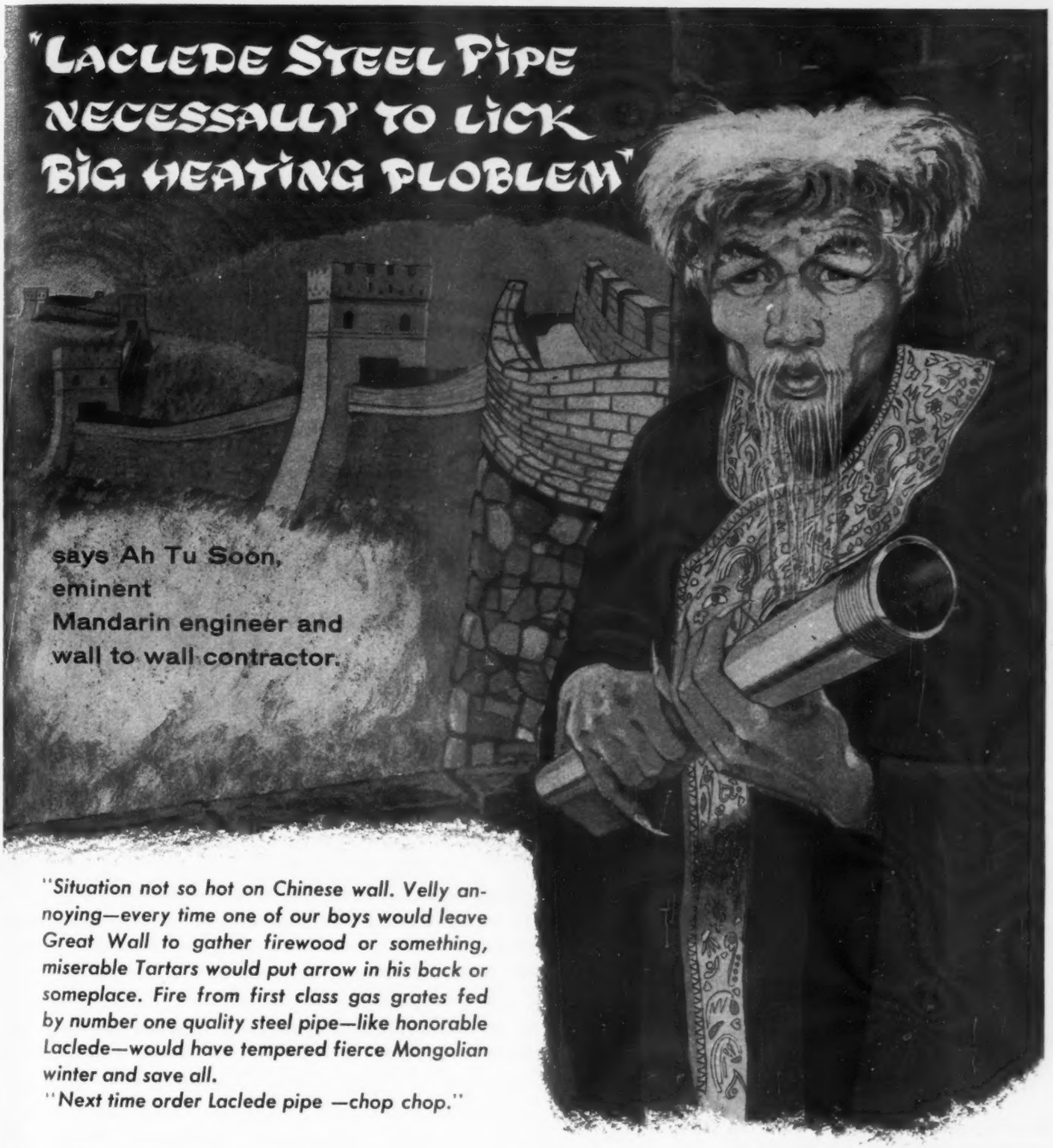
13-15 GAMA annual meeting, Boca Raton, Florida.

16-19 A.G.A.-EEI national conference of electric & gas utility accountants, The Chase-Park Plaza Hotels, St. Louis, Missouri.

17-18 PCGA commercial-industrial sales conference, Los Angeles area.

18-20 Southwestern Gas Measurement Short Course, University of Oklahoma, North Campus, Norman, Oklahoma.

20-21 Indiana Gas Association annual convention, French Lick, Indiana.



"Situation not so hot on Chinese wall. Velly annoying—every time one of our boys would leave Great Wall to gather firewood or something, miserable Tartars would put arrow in his back or someplace. Fire from first class gas grates fed by number one quality steel pipe—like honorable Laclede—would have tempered fierce Mongolian winter and save all.

"Next time order Laclede pipe —chop chop."

LACLEDE STEEL PIPE

Steel

LACLEDE STEEL COMPANY

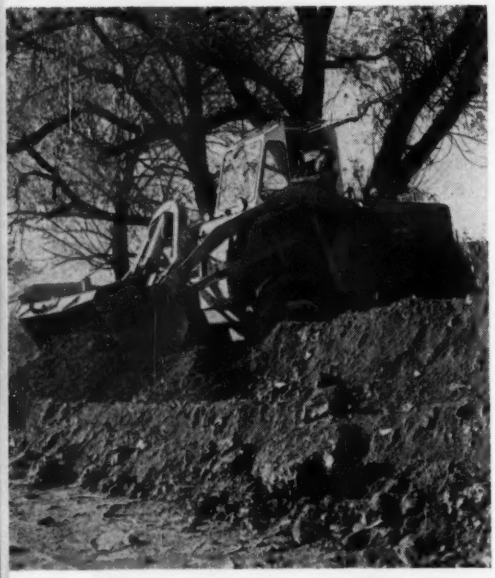
SAINT LOUIS 1, MISSOURI

Producers of Quality Steel for Industry and Construction.

During gas line installation in Monticello, Northern Indiana Public Service Co. construction crews use pneumatic tools to break up the pavement ahead of ditcher.

Distribution Developments

NEWS ABOUT CURRENT AND PLANNED CONSTRUCTION



In Hammond, Indiana, NIPSCO tractor-shovel gives decent burial to 2-in. main.

Trencher carves bed for new 8-in. NIPSCO gas main extension along U. S. Highway 112 bypass in Elkhart, Indiana.

Northern Indiana Public Service Co., Hammond, Indiana, has purchased (for approximately $97,000) Indiana Gas and Water Co's. butane gas system in North Manchester and plans to bring natural gas to the community in 1961. Plans include a 14 mile 8-in. line to connect the North Manchester system to NIPSCO's northwest gas supply network at a point near Wabash at an estimated cost of $600,000.

NIPSCO is seeking a gas franchise in the community of Middlebury; preliminary resolution was passed at a recent meeting of the Middlebury Town Board, setting the exact form of the franchise.

Natural gas began flowing into the new distribution system in December. Project included a 10 mile 6-in. supply line and a distribution system consisting of 2 miles of 6-in., 2.5 miles of 4-in., and 8 miles of 2-in. main.

Construction of the Wakarusa distribution systems has also been completed. Other recent turn ons are Walkerton, Bourbon, Reynolds, Monticello, and North Liberty. Construction is still progressing in Milford Junction, Remington, Syracuse, Fowler, Wolcott, Kentland, Goodland, and Ligonier.

Union Light, Heat & Power Co., Cincinnati, Ohio, plans a $1,000,000 underground gas storage cavern near Parkhills, Ky., a Cincinnati suburb. Union Light is a northern Kentucky operating subsidiary of Cincinnati Gas & Electric Co. The underground storage project, scheduled for completion next December, will be used to supplement CG&E's gas supply.

Louisville Gas & Electric Co., Louisville, Kentucky, has installed new gas dispatching facilities at its 7th and Ormsby Street building. The new South service center on Jennings Lane has been completed; both electric and gas distribution crews pick up materials and equipment stored here, for construction and maintenance work in the area. Mims Pipeline Construction Co., Inc. contracts city distribution work for the company; installs mains and services ranging from 2 to 8-in.

New Barber-Greene 7′ Wheel Ditcher crowds through rugged caliche in Texas—at speeds many times greater than ladder ditchers or back hoes working in the area. Write for details.

NEW 7-FOOT WHEEL DITCHER

digs more ditch . . . deeper ditch than any machine in its size range

Barber-Greene's new 7′ wheel ditcher offers more ditch for the money than ever before. It digs deeper than any wheel ditcher in its size and price range.

Check these advantages:

Advanced design. Greater maneuverability—smaller, more compact than other wheel ditchers digging to 7′. The only wheel ditcher available with point of balance at center of tracks.

Costs less to operate—exclusive Barber-Greene design advantages add up to more ditch per day with less maintenance . . . less down time . . . less wear.

Full range of crowding speeds—exclusive Barber-Greene Hydra-Crowd provides infinite range of crowding speeds . . . permits top digging capacity in all conditions.

Easier to operate—full hydraulic controls within easy reach means less operator fatigue . . . easiest steering . . . greater accuracy.

All-hydraulic spoil conveyor—10′ variable-speed conveyor loads directly into trucks . . . handles spoil at speeds to 640 fpm. Folds to 8′. Rubber impact rollers reduce belt wear, eliminate material build-up beneath belt.

New, compact size—only 26′5″ long, 8′6″ high in operating position. 7′ wide across tracks.

Manufacturer of the only modern ditcher line

Representatives in Principal Cities of the World

Barber-Greene BG

Main Office and Plant AURORA, ILLINOIS, U. S. A.
Other Plants: DeKalb, Milwaukee, Detroit, Canada, England, Brazil, Australia

CONVEYORS • LOADERS • DITCHERS • ASPHALT PAVING EQUIPMENT

TRENCHING — Rear-mounted Backhoe easily works around obstructions to install trenches. Digs at any angle up to 90° either side; 12-ft. maximum depth.

PIPE LAYING — PAYLOADER operates as a crane and a shovel. Hydraulic Side-boom attachment can lift up to 12,000-lbs. at 4-ft. overhang, 6,000-lbs. at 8-ft.

PAYLOADER®

PADDING TRENCH — Versatile Drott "4-in-1" bucket accurately meters dirt padding into trench, also moves quickly to backfill, grade, do cleanup work.

BACKFILLING — PAYLOADER can dig, carry and load any material; has traction and flotation for any terrain; large tires prevent damage to paved surfaces.

Short-cuts for Pipeliners

No other machine in your entire equipment spread can do as *much work* or as *many different jobs* as a PAYLOADER tractor-shovel.

Investing in a PAYLOADER means you have only one machine to operate and maintain. Yet, its multi-purpose usefulness pays-off because it handles so many phases of pipeline construction and maintenance work, such as grading, trenching, pipe-handling, backfilling.

Only a PAYLOADER can be equipped with as many as three working tools (bucket, backhoe and side boom) at the same time, to be used at will without losing time making equipment changes. Four-wheel drive and big pneumatic tires give plenty of traction and flotation on any terrain, and ability to work on paved surfaces without damage.

Get the complete PAYLOADER story from a nearby Hough Distributor. He is ready to help you select the 4-wheel drive model (5 sizes up to 12,000-lb. operating capacity) and attachment combination that best fits your needs. Contact him today.

THE FRANK G. HOUGH CO. 2-B-4
960 Sunnyside Ave., Libertyville, Ill.

Send full data on PAYLOADER tractor-shovels and Attachments

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Distribution Developments

Arizona Public Service Co., Phoenix, Arizona, plans to install in the metropolitan area of Phoenix this year approximately 276,000 ft of 1¼-in. plastic, and 128,000 ft 1¼ steel mains; 415,200 ft of 2-in. plastic and 276,800 ft of 2-in. steel mains; 58,000 ft of 3-in., 11,000 ft of 6-in. and 16,400 ft of 10-in. steel mains for extension, replacement, relocations, and tie lines. Approximately 144,000 ft of 4-in. steel and 29,000 ft of 4-in. plastic mains are scheduled for the area. Company crews will also install approximately 967,000 ft of ½-in. plastic pipe and 195,000 ft of ¾-in. steel pipe for replacements and relocations of service lines.

Other 1961 projects include installation in Parker, Arizona, of 32-miles of 3-in. steel high pressure feeder line. In the Parker area distribution systems company crews will install a plastic pipe system to include approximately 11,000 of 1¼-in., 23,000 ft of 2-in., 4,000 ft of 3-in., and 6,000 ft of 4-in. intermediate pressure lines. Approximately 37,000 ft of ½-in. plastic and 1-in. steel service lines will also be installed during the year.

Another project planned is construction of a $1.5 million service center in Deer Valley, northwest of Phoenix to house most of the gas and electric shops and garage and warehouse facilities now located at APS's general office building in Phoenix. Construction is expected to get underway in February; completion is scheduled for mid-summer. The new service center will be located near old Paradise Valley Airport south of Peoria Avenue, bounded on the east and west by 21st and 23rd Avenues and on the south by Mountain View Road.

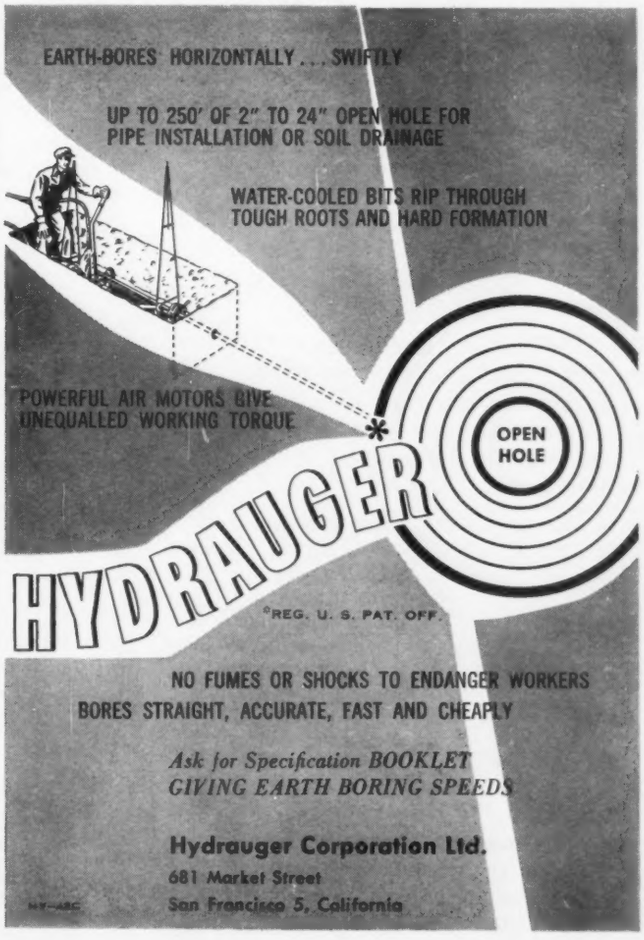
Mississippi Valley Gas Co., Jackson, Mississippi, has completed a new distribution system in Macon, Mississippi. Project involved approximately 10,000 ft of 4-in. main. Contractor was Eubanks & Smith Pipeline Construction Co. of Greenville, Mississippi.

Iowa Electric Light and Power Co., Cedar Rapids, Iowa, plans to install a distribution system to serve the town of Chariton, Iowa, in 1961. Plans are underway to secure FPC approval of a 17 mile 6-in. line from Natural Gas Pipeline Co. of America to the town. Estimated date for first flow of natural gas to Chariton is May 1, 1961.

Iowa Public Service Co., Sioux City, Iowa, plans to install distribution systems in 40 towns in central and western Iowa in 1961. Contracts have not been determined. IPS is awaiting word from Northern Natural Gas Co. as to approximate date it will start construction of pipelines to the communities. Distribution project involves a total of 903,000 ft of ¾ to 8-in. intermediate pressure mains and services. Tentative time table of construction of distribution systems are — May, Group 4, Orange Center; May-June, Group 7, Brayton, Elkhorn, Irwin, Earling, and Defiance; June, Group 2, Clarksville, Plainfield, Shell Rock; July, Group 3, New Hartford, Allison, Aplington, Bristow, Dumont, Kesley, and Parkersburg. Scheduled for July-August are Group 1, Chapin, Hampton, Latimer, Sheffield, and Thor; Group 5, Ruthven, Calumet, Alvord, and Doon; and Group 9, Archer, Germantown, and Newkirk. In August-September, Group 6, Merrill, Moville, Lawton, and Jefferson, South Dakota, distribution systems are scheduled to be installed.

Iowa-Illinois Gas and Electric Co., Davenport, Iowa, recently completed a distribution system to serve the town of Badger, Iowa near Fort Dodge. Currently company is seeking a gas franchise from the City of Durant, Iowa.

IT'S NEW!
EASIER TO USE!
IMPROVED DESIGN!
NEW BALANCED RING GEAR-SADDLE ASSEMBLY!
MODEL NO. 1-SA
QUICKER OPERATION!
PATENT APPLIED FOR
7"
MOUNTS AND CUTS ON SHORT LENGTHS OF PIPE!
For a welcome distinctive change in pipeline equipment, Mathey is proud to announce their newly designed Pipe Beveling Machine. It's extremely lightweight and requires only ½ the storage space. No. 1-SA machine can be operated on pipe segments as short as 9" and still cut 1" off pipe. In larger models weight is proportionately lighter.
Call or Write for Further Information or Demonstration.
C. A. Mathey MACHINE WORKS, INC.
212 So. Frankfort Tulsa, Okla. • Box 1159 • Gibson 7-3311


EARTH-BORES HORIZONTALLY . . . SWIFTLY
UP TO 250' OF 2" TO 24" OPEN HOLE FOR PIPE INSTALLATION OR SOIL DRAINAGE
WATER-COOLED BITS RIP THROUGH TOUGH ROOTS AND HARD FORMATION
POWERFUL AIR MOTORS GIVE UNEQUALLED WORKING TORQUE
OPEN HOLE
HYDRAUGER
*REG. U. S. PAT. OFF.
NO FUMES OR SHOCKS TO ENDANGER WORKERS
BORES STRAIGHT, ACCURATE, FAST AND CHEAPLY
Ask for Specification BOOKLET GIVING EARTH BORING SPEEDS
Hydrauger Corporation Ltd.
681 Market Street
San Francisco 5, California

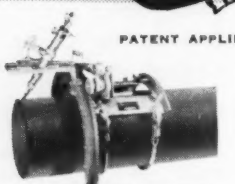
Construction crews of Laclede Gas Company get ready to weld another section of gathering line that will connect new injection-withdrawal wells to the new Roubidoux formations in its underground storage field near St. Louis, Missouri.

Western Kentucky Gas Co., Owensboro, Kentucky, spent approximately $1,827,000 for construction of new facilities in 1960. Two new distribution systems were installed at a cost of $210,000. Elkton with a potential of 500 customers, and Reidland, a Paducah suburb with a potential of 400 customers, were completed late in the year.

New Orleans Public Service Inc., New Orleans, Louisiana, moved construction and maintenance schedules up to complete gas main work in advance of a street widening and resurfacing project by the city of New Orleans on Orleans Ave. from North Villere St. to North Claiborne Ave. NOPSI was consequently able to avoid cutting into newly-paved street at a later date. Project involved maintenance on 1200 ft of 12-in. cast iron main on the river side of North Claiborne Ave. and 200 ft of 4-in. cast iron main on the uptown side of Orleans Ave. Approximately 300 ft of 4-in. cast iron main was replaced by 6-in. steel main on the downtown side of Orleans. In other projects, 2800 ft of 12-in. cast iron main was placed with steel main on Canal Blvd. and some 39 services reconnected to the new piping. In the Harmony and Camp street areas, feeder mains were enlarged to increase effectiveness of gas department's system over a larger area.

Atlanta Gas Light Co., Atlanta, Georgia, spent approximately $4,900,000 or 57% of its total 1960 construction budget ($8,658,000) to extend its mains and connect 17,478 new customers. Approximately $1,300,000 or 15% was spent to increase company's standby propane facilities. Remainder of the construction expenditures represented general improvement and new equipment. 1961 construction budget is not yet available.

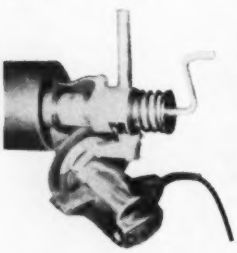
PATENT APPLIED FOR



STANDARD MACHINES

Fast, easy, accurate cutting and beveling of all sizes of pipe from 1½" through 36". Simple operation assures perfect cuts and bevels from moment torch is lighted.

PATENT NO. 2,869,393



BEVEL-LAND GRINDER

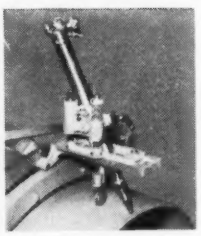
Smooths pipe cuts and accurately places the lands on bevels in a matter of seconds. Eliminates costly, time - consuming handwork.

H&M ACCESSORIES

Motorized Units
Flexible Shaft • Pipe Dollies
Boxes • Clamps

INSTALL PIPING SYSTEMS FASTER . . . EASIER, WITH

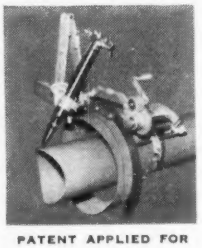
H & M PIPE CUTTING AND BEVELING MACHINES



PATENT NO. 2,843,373

OUT-OF-ROUND

Makes cutting of irregular pipe easy, simple. Roller rides surface of pipe, insures even, accurate cuts. Fits all sizes of H&M Machines.



PATENT APPLIED FOR

SHAPE CUTTER

Cuts saddles, tees, els and other irregular designs. The lightweight extremely portable Shape Cutter fits all models of H&M Machines.

H&M ™ Reg

PIPE BEVELING MACHINE CO.

311 E. Third St. LU 3-0241
TULSA, OKLAHOMA

This Case 430 *Utility* machine gives you fast, powerful dig-capacity to 10′ deep, plus heavy-duty construction equal to larger-size rigs.

why buy more "hoe" than you need?

DIGGING • LIFTING

HANDLE WITH CASE *Utility*

LOADING • CARRYING

There's no longer any need to invest big money in an "oversize" backhoe to get extra dig-power for *your* kind of work. As a free demonstration will quickly prove, the highly-maneuverable Case 430 *Utility* Backhoe-Loader will give you all the dig-depth, work capacity and heavy-duty construction you need — *plus* the budget-saving economy of a smaller, more versatile machine.

on trench-work Model 430's powerful hydraulics let you reach-out and dig over 15′ from pivot, *cut 10′ deep,* bite big bucketloads with up to 10,000 lbs breakaway . . . cast or load into trucks over 10′ high. You can dig extra "hole" per hour because *exclusive* foot-operated hydraulic swing speeds dig-dump cycles by leaving hands free to control bucket and dipper-stick while swinging. You save maintenance and repairs because 430 Backhoe is a "copy" of larger J. I. Case hoes . . . including boom, dipper-stick, and all 8 size buckets of extra-strength *alloy* steel.

on backfilling and clean-up, Model 430's husky 1200-lb loader is sized "right" for power, speed and economy. Equipped with *high-torque Case-built gasoline or diesel engine,* the stable Model 430 Tractor gives you low-maintenance design including 11″ ferrometallic clutch, high-strength "backbone", oversize rear and massive forged front axles, and many more big-tractor features.

See and try this first really heavy-duty 10′ digger in the low price field! Call your Case Dealer for free demonstration today! Or for complete information write J. I. Case Co., Racine, Wis., Dept B1731

CU-BL-301

CASE

J. I. CASE CO., RACINE, WIS.

Distribution Developments

The Gas Service Co., Kansas City, Missouri, plans to install 5 new distribution systems to serve 3 communities in Missouri and 2 in Kansas. Contractors will install the Missouri systems.

In Peculiar, Mo., contract has not been let. Project includes installation of approximately 6670 ft of 2-in., and 18,775 ft of 4-in.

Luther G. Harper Construction Co. has the contract for the Seneca, Mo., system which involves an 8 mile 4-in., 2 mile 6-in. supply line from Cities Service Gas Co.'s transmission line to the town, and 32,490 ft of 2-in.; 5600 ft of 3-in., 2870 ft of 4-in., and 9500 ft of 6-in. for the distribution system. Work began December 19.

The new system in Ozark, Mo., will include 11 miles of 4 and 6-in. supply line from Cities Service and in the distribution system another 28,295 ft of 2-in., 9745 ft of 3-in., and 5586 ft of 4 to 6-in. will be installed. Completion date is set for April 1. Contractors for the project are Breese & Sons for the main line tap and M & M Construction Co. for the distribution system.

Company crews will install the two Kansas distribution systems. At Goddard approximately 9847 ft of 2-in.; 5140 ft of 3-in., 19,182 ft of 4-in. and 185 ft of 6-in. are scheduled to be installed by March 15. At Stanley, installation of 2920 ft of 2-in., 4250 ft of 3-in. and 15,840 ft of 4-in. is underway and scheduled to be completed in February.

Work is underway at Stanley, a small community 9 miles east of Olathe, Kansas, and 20 miles south of Mission on U. S. Highway 69. Company crews expect to complete installation of 2920 ft of 2-in., 4250 ft of 3-in., and 15,840 ft of 4-in. by end of February.

Construction is now complete on 32,700 ft of 12-in. main in the northwest part of Greater Kansas City area that will provide more adequate gas supply to area south of Liberty and in Liberty proper. Line runs from north end of Missouri river bridge to the town border station at Liberty. Running along the west side of Liberty, the line will eventually have extensions, made eastward to serve the community more fully. New line parallels existing 6-in. line. Pitman Construction Corp. of Grandview, Mo., was the contractor.

Approximately 1000 customers will be added to Gas Service lines as a result of 3 recently completed distribution systems in Kansas. Involved were 23,550 ft of 2-in., 3240 ft of 4-in., and 5320 ft of 6-in. project at Elwood, Kansas. In Wathena, 13,000 ft of 2-in.; 5570 ft of 4-in., and 3665 ft of 6-in. were installed. At Troy, approximately 19,000 ft of 2-in., 10,000 ft of 4-in. and 500 ft of 3-in. were installed. Approximately 1800 ft of 8-in., 19,000 ft of 6-in., and 39,360 ft of 4-in. were installed to serve these towns from the Cities Service line on the west side of the Missouri River and just west of St. Joseph, Mo.

Equitable Gas Co., Pittsburgh, Pennsylvania, has construction underway on a new service center headquarters building for its Division "E" that will provide a 28,000 sq ft of office, work, and garage space. Completion is scheduled for early spring. When the new concrete block construction building located at Clyde Street and Port Perry Road in North Versailles Township is completed, two centers at 2606 Fifth Avenue McKeesport, and Fifth and Cherry Streets, Braddock, will be closed. Approximately 150 men who handle main and service lines, meter work, and customer service work for Division E will be headquartered in the new center.

STRAIGHT LINE PAN MOVEMENT

it's easy with this Improved Lancaster carrier wire assembly

2 NEW Lancaster FEATURES FOR INCREASING GAS METER ACCURACY

There's no chance for a diaphragm pan to start traveling in an arc when you install this improved Lancaster Carrier Wire Assembly.

SIDE CARRIER BRACKET **height can be quickly adjusted for most accurate positioning. No wire bending.**

OVAL SLOT CENTER BRACKET **permits diaphragm pan to travel straight through. No chance for wear.**

Oval slot center brackets available separately can be adapted to any carrier wire. Porous bronze and graphite bushings used throughout. Order now for easier installation and increased meter accuracy.

Lancaster METER PARTS CO.

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Manufacturers of Quality Parts for Gas Meters

A meter is only as accurate as its parts . . . and Lancaster quality parts are guaranteed to outperform the original parts.

ASSURED SAFETY

in all your gas operations!

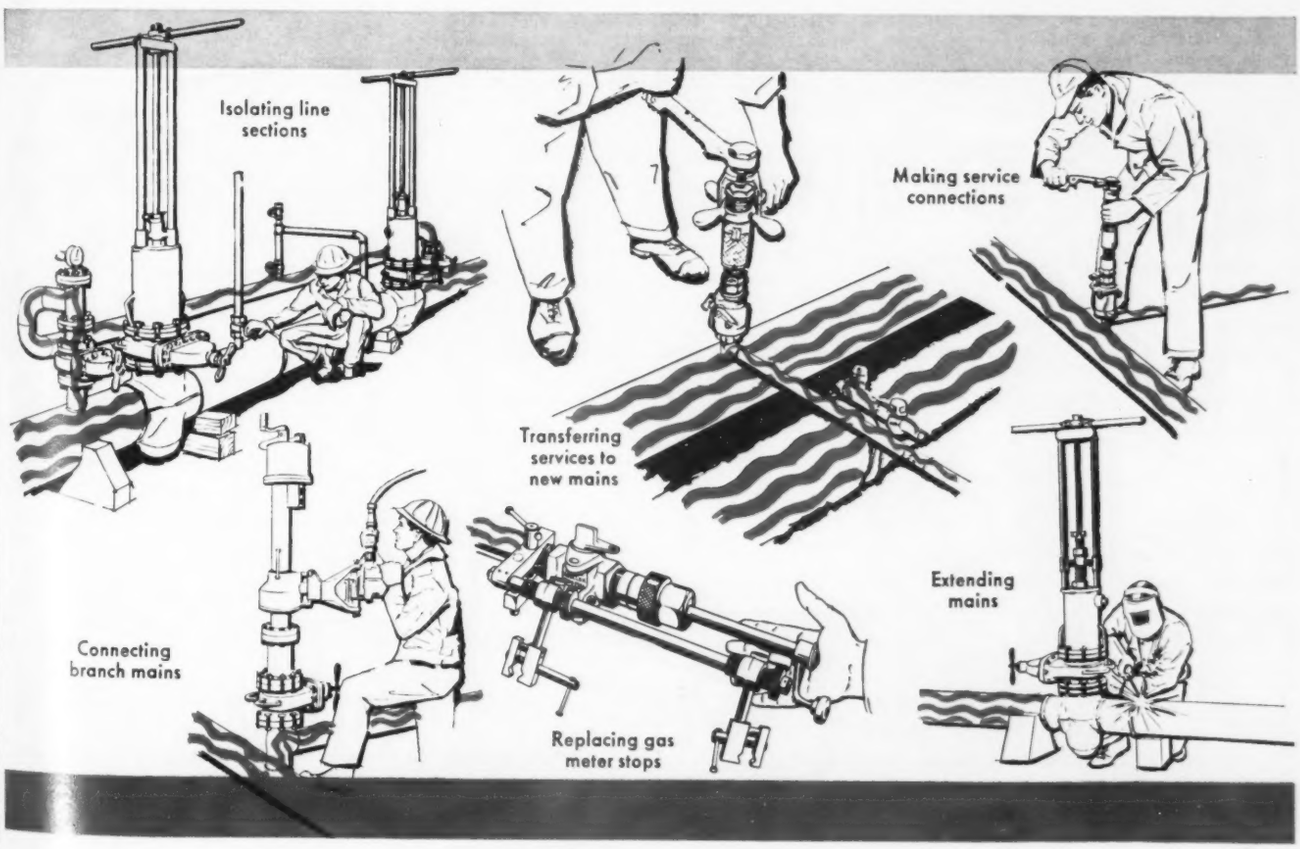
MUELLER® NO-BLO® METHOD

■ Safety for your customers and for your employees is a prime consideration of gas utility management.

One of the most significant contributions you can make to safe operating practice in your company's operations is to insist upon the use of Mueller No-Blo methods.

The No-Blo Method is a simple operating procedure that allows all connections to be made under pressure without the escape of gas — assuring safe working conditions for your employees. This positive confinement of gas at all times, plus the rugged, "service-proven" dependability of Mueller Products assures the safety of your customers now and in the future. And both you and your customers will like the time-and-money-saving convenience of uninterrupted service!

If you are not familiar with the safe Mueller No-Blo Method, contact the local Mueller Representative in your area. He will be happy to explain the application and use of the complete line of Mueller No-Blo Products and Equipment and to refer you to other companies who are taking advantage of these safe operating procedures.



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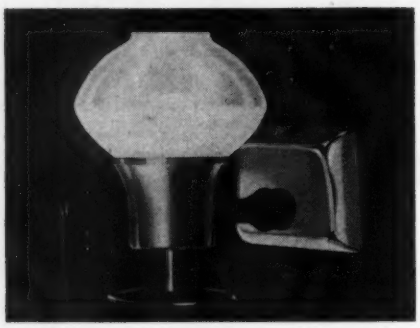

Satelite . . . a gas lamp of ultra-modern styling suitable for use inside the home or lodges, motels, hunting camps and trailer parks . . . is being manufactured by Humphrey Products Division, General Gas Light Co. Manufacturer claims a substantial increase in brightness has been achieved by using half-frosted globes made of heat-resistant Pyro-Glass, and high temperature ceramic nosepieces that increase mantle brilliance.

CIRCLE (1) ON THE REPLY CARD

Smokeless-odorless incinerators for heavy-duty use in commercial and industrial installations are illustrated and described in new 4-page, two-color condensed catalog from Winnen Incinerator Co. Included are custom-built models, portable models, and pre-fabricated chimneys with complete specifications and list of distributors.

CIRCLE (2) ON THE REPLY CARD

Equipment specifications and applications of Midwestern's "Little Boomer" hydraulic sideboom for the International T-340 track-type tractor, are detailed in new bulletin from Midwestern Manufacturing Co. Sideboom and crawler are cited as low-cost pipe-laying team with ample capacity for a wide range of gas distribution and industrial operations.

CIRCLE (3) ON THE REPLY CARD

House service regulators . . . Reliance type K . . . are described in new 4-page bulletin from American Meter Co. Regulators are available in sizes from ¾ to 1¼ inches and conform to A.S.A. Code B-31.1.8-1955 for house service use. Maximum inlet pressure is 125 psi.

CIRCLE (4) ON THE REPLY CARD

Ready-mixed epoxy enamel for maintenance coating on surfaces and equipment exposed to alkali and acid fumes is now available from Du Pont's industrial maintenance finishes sales section under the trademark "Corlar." The new paint . . . an epoxy ester paint . . . offers an order of chemical resistance between the catalyzed epoxies and alkyds. Single-packaged, the ready-mixed material eliminates mixing in the field as well as problem of limited pot life of catalyzed epoxy formulations. Has good durability in salt air exposure, persistent condensate, and moisture. Recommended for wood, masonry, and metal.

CIRCLE (5) ON THE REPLY CARD

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LOWEST COST SERVICE LINE TRENCH FOR GAS DISTRIBUTION

Trench for gas service lines at lowest cost with the machine that gives extra traction and flotation . . . digs in any soil, even in frost or rocky conditions. The M-322 CR digs widths to 12", depths to 5'.

12 HP Crawler Model M-322 CR shown

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Southern Cross Foresters, like the little Dutch boy, keeps "its finger in the dike" for the gas distribution industry. Like a leak in the dike, without attention unaccounted for grows and grows. Our "Contract Leakage Control Service," both survey and repair, can supply expert help as you need it . . . when you need it, without costly build-up of personnel and equipment. For complete information about SCF Leakage Control Service, call collect.

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Three air conditioning systems . . . new 3, 10, and 15-ton units . . . have been developed by Gascool Div. of Vector Engineering Contractors, Inc., to complete a series of natural gas or LP-Gas powered air conditioning systems for residential or institutional use. Other systems included in the series are 5 and 7½-ton capacity units. Average fuel requirement of the new equipment is 20 cu ft of 1000 Btu gas per-ton-hour of operation. Systems are custom-built; can be installed either outdoors or roof-mounted.

CIRCLE (6) ON THE REPLY CARD

Dust Topics . . . 44-page publication available free from Gelman Instrument Co. describes new equipment for dust and gas samples and surveys, air pollution analysis, and special sub-micron filtration. Gives complete specifications, operating characteristics, and prices for each of over 100 instruments.

CIRCLE (7) ON THE REPLY CARD

* * *

One of the nicest things about old age is that you can whistle while you brush your teeth.

One attachment . . . Drott 4-in-1 bucket . . . equips Hough's Payloader rubber-tired tractor-shovels to do excavating and loading, bulldozing, clamshell pick-up, and scraping and grading. Hydraulically adjusted jaws of the buckets enable operator to do such a wide variety of jobs. Two new size buckets . . . a 4 and 1 cu yd capacity . . . are now available, making it possible to equip the entire line of 4-wheel-drive Payloaders with these tools. Literature and specs available.

CIRCLE (8) ON THE REPLY CARD

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Propeller type flowmeter . . . that changes gas velocity to a millivolt signal, the frequency of which is proportional to the flow rate . . . is described in new specification bulletin from Fischer & Porter Co. Output signal from the turbine flowmeter can be fed into standard F&P digital totalizers and indicators, or by means of a frequency to dc converter, the signal can be fed to any potentiometric receiver.

CIRCLE (9) ON THE REPLY CARD

"Brush-on galvanizing" with Z.R.C., a free-flowing compound consisting of 95% pure zinc in the dried film that, essentially, "galvanizes" iron or steel surfaces is said to provide protection equal to or better than hot dip galvanizing and electroplating. As a prevention against corrosion the Z.R.C. material is said to be effective in protecting large structures, such as gas holders or LPG-storage tanks, at savings up to 75% compared to other methods. Material is ready to use right from the can, no special mixing required. Coverage costs said to be as low as 1½ cents per square ft. Bulletin, 4-pages, two-color, describes material and application.

CIRCLE (10) ON THE REPLY CARD

Industrial price and general data bulletin on flexible hoses manufactured by Flexaust Company includes application, selection, and installation information as well as prices. Designed for moving air, dust, fumes and materials via pressure, suction, gravity, flexaust hose are made of neoprene coated cotton, nylon, or glass fabrics, single or double ply.

CIRCLE (11) ON THE REPLY CARD

reduce repair problems

STANDARD MAGNESIUM ANODES CUT MAINTENANCE COSTS, ELIMINATE HAZARDS, REDUCE UNACCOUNTED-FOR GAS!

Maintenance costs are skyrocketing. Yet a simple, effective method of reducing or completely eliminating these costs is with Standard Magnesium Anodes. And they eliminate hazards and reduce unaccounted-for gas.

A cathodic protection system using Standard Magnesium Anodes is inexpensive and easy to install. It will add years of maintenance-free life to old as well as new lines by stopping corrosion.

Protect that next installation by using Standard Magnesium Anodes.

FREE: Booklet describing how you can prevent corrosion.

QUALITY AND DEPENDABILITY THROUGH RESEARCH

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WATER HEATER ANODES • GROUND ANODES

PRODUCT

New backfiller deposits dirt back in the ditch in one pass using a 24-in. power driven auger, 7.5 ft long. The Pow-R-Ditch Filler, available from Vermeer Manufacturing Co., is powered by a rear-mounted 36-hp engine, features highly maneuverable 4-wheel drive unit jointed in center for easy steering and better control. Operator's platform is located above auger for clear unobstructed visibility ahead and behind unit.

CIRCLE (12) ON THE REPLY CARD

Lunkenheimer ball valve . . . 400 lb w.o.g., ¼ to 2-inches . . . is described in 2-page catalog sheet. Operation of the valve, cutaway views, ratings, and specific design features and dimensions, as well as reports on applications and advantages are detailed in the literature.

CIRCLE (13) ON THE REPLY CARD

Properties and advantages of nodular cast iron as a material for control valve body construction are described in technical paper prepared by Fisher Governor Co. In easy-to-understand language, the report covers chemical and mechanical properties of nodular cast iron and its performance when subjected to high and low temperatures, corrosion, thermal shock, and welding conditions. Heat treatment, machineability, strength, impact resistance, and fatigue resistance are also covered.

CIRCLE (14) ON THE REPLY CARD

New catalog . . . covering Bay Products' line of work benches, bins, cabinets, shelving, stock carts, and special accessory equipment . . . points out exclusive features of new modular work benches as choice of widths, interchangeability with non-pedestal legs, and recessed or flush mounted handles and hardware that eliminate projection points.

CIRCLE (15) ON THE REPLY CARD

Improved pipe joint . . . now available in wide range of sizes — from ⅜ to 4-in. and in lengths from 2 through 36-in. . . . is designed to join plain pipe ends quickly and easily without cutting or threading the pipe. New coupling absorbs pipe vibration and shock and is corrosion resistant. Allows up to 4 degree angular misalignment and permits both angular and axial pipe movement without leakage. Meets ASA requirements for 150 lb service with temperatures from minus 40 to plus 250 F. Elbows, crosses, and tees are also available.

CIRCLE (16) ON THE REPLY CARD

PARADE

Self-contained gas-fired water heater . . . for commercial, industrial, and institutional applications . . . is said to eliminate costly scaling problems. An indirect-immersion-type, the storage water heater actually stores service water at the prescribed temperature. Employs three basic systems — a gas-burning system or furnace part of the unit, a forced circulation transfer fluid system and finally storage, heating, and temperature control. Water heater is simple, inexpensive to install, features automatic "gimmick" free operation, and absolute safety under all conditions. Free literature available from Patterson Kelley Co.

CIRCLE (17) ON THE REPLY CARD

Pipe wrap . . . made of continuously drawn glass fibers . . . features high tear strength of 8 lb minimum, tensile strength of 80 lb per 6-in. width, and uniform thickness of approximately 20 mils plus or minus 2 mils. The Glass Wrap available from Texas Glass Fiber Products Div., is said to eliminate wrapping breaks resulting from uneven tensile strength found in blown glass type fiber mats; to eliminate moisture wicking into exposed ends of twisted fiber bundles found in yarn type mats, and to eliminate "jeeping" due to uncontrolled fibers standing out from enamel surface.

CIRCLE (18) ON THE REPLY CARD

Permanent cast couplings . . . are the subject of 2-color, 12-page booklet published by Smith-Blair, Inc. Brochure describes and illustrates line of cast couplings for all classes and sizes of cast iron pipe including cast insulating couplings and a special cast "cut-in" coupling for repairing broken and deflected pipe.

CIRCLE (19) ON THE REPLY CARD

Combination cleaner-snubber . . . to be used in place of separate air intake filters and silencers for industrial equipment such as reciprocating compressors, positive-displacement blowers, and gas engines . . . is described in 6-page bulletin from Industrial Silencer Div. of Burgess-Manning Co. Units are available in 8 to 30-in. inlet-outlet sizes, and from 1400 to 19,600 cfm capacities.

CIRCLE (20) ON THE REPLY CARD

"Hope you're not bothered too much by people barging in . . . this was a washroom."

Brochure illustrates versatility of Palmer Shile series 75 adjustable storage racks; lists shelf beam loads in load pounds and span inches. Almost infinite combination of storage heights and depths, in single, double, and multiple openings (including adjustability on 3-in. centers from floor to top of rack) are available.

CIRCLE (21) ON THE REPLY CARD

OIC gate valves . . . designed specifically for ductile iron . . . are subject of 12-page product brochure that gives complete engineering specifications, pressure-temperature ratings, and testing data. Both the Pipe-Pal series of ½- thru 2-in. small gate valves and the Pipe-Mate series of 2- thru 12-in. large gate valves are described.

CIRCLE (22) ON THE REPLY CARD

Extension fitting . . . designed to extend 2-in. and smaller live gas mains at operating pressure of 100 psi or less . . . is said to eliminate installation of a fitting ahead of the tie-in point, stopping the live gas, and then cutting existing end in order to make final tie-in. All that is required with the Berg extension fitting is installing of fitting between existing live main and new main, then tapping. The end cut off of the existing main and shavings drop into 5-in. cavity provided below the inlet-outlet apertures in the fitting.

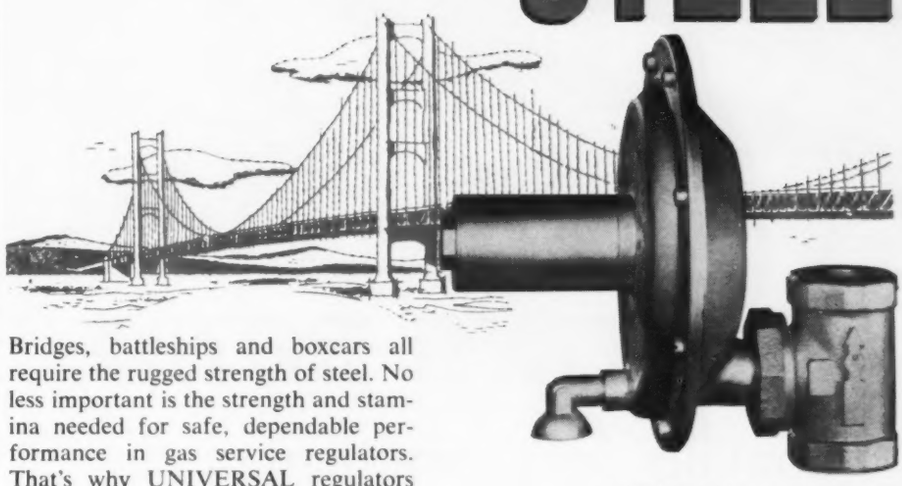
CIRCLE (23) ON THE REPLY CARD

* * *

"Sam, you've been drinking for many, many years — why don't you stop?"

"What? And give up something I've got $50,000 invested in!"

the strength of **STEEL**



Bridges, battleships and boxcars all require the rugged strength of steel. No less important is the strength and stamina needed for safe, dependable performance in gas service regulators. That's why UNIVERSAL regulators are made exclusively of steel. They are shock resistant, lighter in weight and thoroughly dependable.

UNIVERSAL regulators for conversion or pressure elevation are available in one packaged unit with breather vent and cathodic insulator. Write for Bulletin No. 521 for complete information.

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UNIVERSAL GAS SERVICE REGULATORS

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- ★ Vital internal parts are made of bronze, stainless steel and aluminum for best corrosion resistance.
- ★ Once installed, regulators cannot be rotated to allow water, dust or other foreign particles to accumulate and disrupt service.
- ★ Engineering design and construction afford many exclusive maintenance and service advantages.

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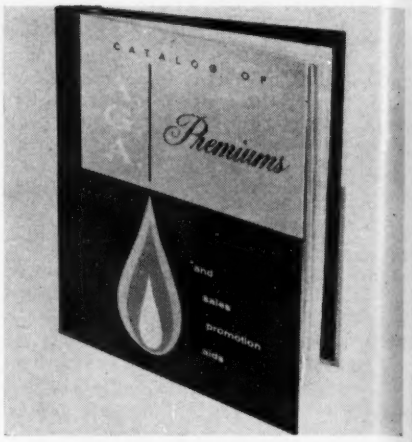

New Catalog of American Gas Association premiums and sales promotion aids is now available in hard-cover, looseleaf form. Information on dozens of premium items and booklets is included. Hard cover with gold imprinting on back binding makes it possible for book to be kept in desk file or bookcase. New catalog is $2 a copy; new pages will be sent free as they become available.

CIRCLE (24) ON THE REPLY CARD

Newly-developed pipe fitting for small diameter pipe from ⅛ to 1-in. OD is described in free bulletin from Marman Div. of Aeroquip Corp. Designed to withstand extreme low or high temperatures and high pressures or vacuum where leak-proof sealing is a requirement, new all-metal fitting assures dependable sealing without leakage even with temperatures ranging from minus 450 to plus 1500 F and pressures up to 16,000 psig. Fitting can also be used as a transition joint to connect dissimilar metals.

CIRCLE (25) ON THE REPLY CARD

GAS DISTRIBUTION ENGINEERS

Engineers experienced in all phases of the engineering and installation of gas distribution systems for cities and towns, including feasibility studies, design, preparation of specifications, field location, and supervision of construction, inspection, testing, conversion and start-ups. Openings for Project Manager and Project Engineers. Salary commensurate with experience. Send summary of experience and education. Box 6840, American Gas Journal, P. O. Box 1589, Dallas 21, Texas.

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